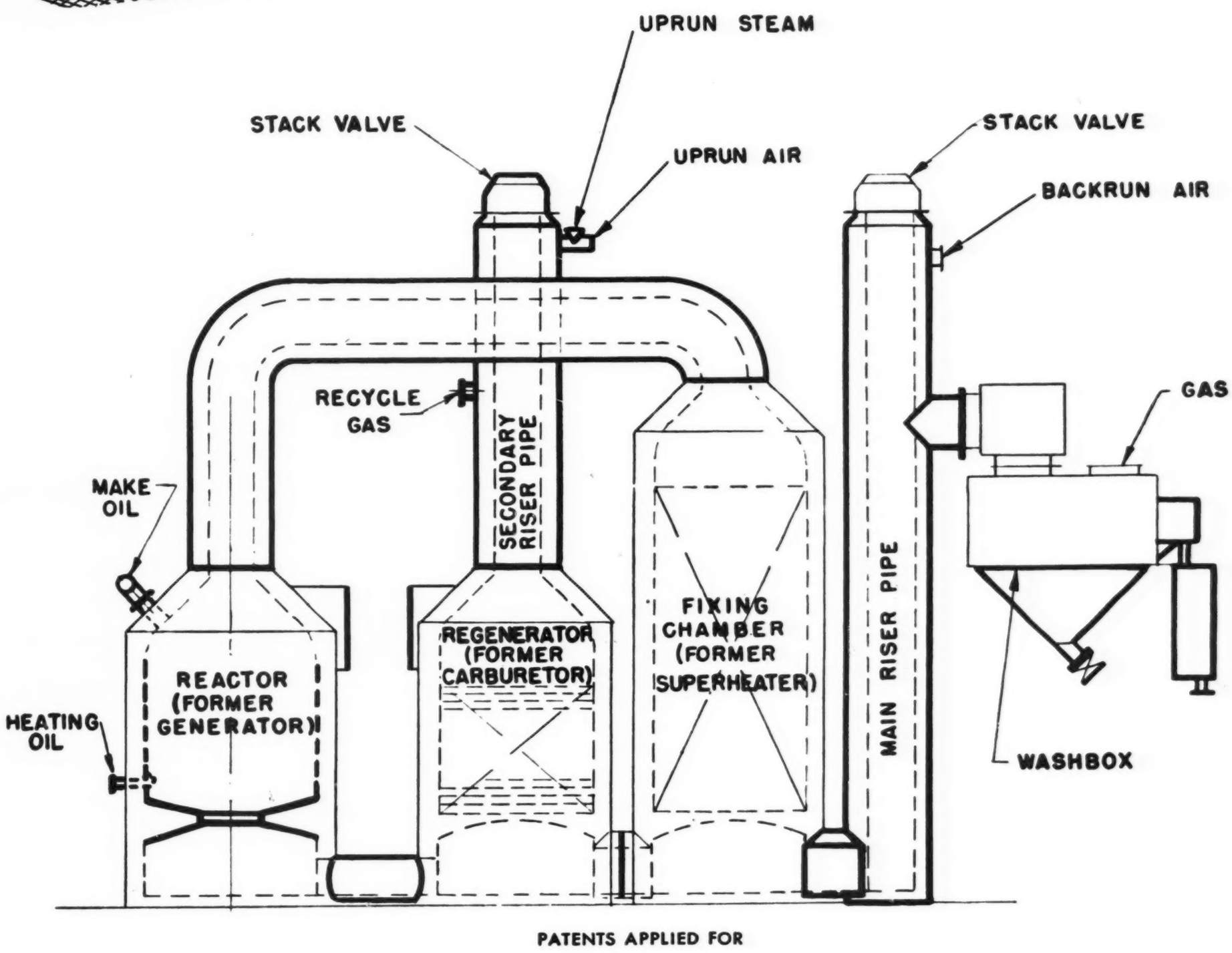
Converting a Standard Water Gas Machine to the Semet-Solvay Regenerative Reverse Flow Oil Gas Process

Heavy lines show changes required to convert to Semet-Solvay Regenerative Reverse Flow Oil Gas Process.



Process as applied to Converted Sets . . .

TO REHEAT: Back blast, then reverse to forward blast with heat oil.

TO MAKE: In one direction only—CARRIER GAS, up through regenerator and reactor, MAKE OIL downward, counter current to CARRIER GAS, thence downward through fixing chamber to wash box.

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GAS

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Twenty-Fifth Year of Publication

December, 1949 ECA NBP **Vol. 25—No. 12**

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Highlights

WEST COAST COMPANY'S PIPE MILL WILL LOCATE IN ORANGE, NOT HOUSTON. Consolidated Western Steel Corp., a U. S. Steel subsidiary, won't build a plant in Houston after all, as announced last month (*GAS*, November, p. 96). A Congressional resolution has since been okayed by the President, permitting sale to ConWes of war surplus facilities in Orange, Texas, located on the company's land adjacent to its existing structural fabricating plant. The Houston site had been selected after the attorney-general nixed an agreement whereby ConWes would buy the Orange plant.

STANDARD 10-TON PER DAY OXYGEN PLANTS AVAILABLE. Stacey Dresser Engineering has announced production of the units, which have a 10.5 gross ton output at 95% purity using atmospheric clean air as raw material. Weighing 80,000 lb, they fit a 32 x 24-ft floor space.

"NATURAL GAS—WHOOSH!" That's the title of *Fortune's* survey of the industry in its current issue. It gives a good overall picture of the tremendous expansion now under way, and tells something of the running battle to serve New England.

SPEAKING OF NEW ENGLAND . . . Texas Eastern, Big Inch operator, has now emerged with a plan to serve the Northwest. Even with Minute Man's and Algonquin's plans tabled, the company will still have to do battle with Tennessee Gas Transmission and Transcontinental for the lush new territory.

TRANSCONTINENTAL'S APPLICATION TO COMMENCE DEC. 7—MINUS NEW ENGLAND PROPOSAL. When the FPC starts hearings on the plea to expand facilities of the Texas-New York line, the proceedings will be consolidated with South Jersey Gas Co.'s request to build 77 miles of line to receive part of the extra load of gas the main line will carry. However, Transcontinental agreed to sever the request for the New England facilities from this hearing.

RANGE COWBOYS KEEP MANUFACTURERS BUSY. What with the Old Stove Roundup running at full tilt, and the corral bulging with tough and tired old critters, manufacturers have stepped up the tempo of range shipments to new records. October saw an all-time high of 260,000 units shipped, says GAMA. That's 2500 more than the corresponding month in 1948, and 2200 over May 1948's 257,800 mark. GAMA thinks the 1 million quota for 1949 will be topped.

AND STILL MORE PIPE. National Tube announced Nov. 19 that extensive overhaul and expansion of facilities at its Lorain (Ohio) pipe and steel mill was virtually complete. Included in the program are the world's first continuous seamless pipe mill and a roofed storage center. Pipe in diameters of from 2 to 4¼ in. will be turned out at the rate of 18,000 tons per month.

WAY CLEARED FOR TEXAS GAS TO RUN TO SAN DIEGO. Although the FPC ruled out Southern Counties Gas Co.'s (Los Angeles) tariff schedules covering gas shipped to San Diego through a newly completed takeoff from the Texas-California line, interim rates were okayed in time to permit the new line to be put into operation last month.

TRUNKLINE FINDS A NEW BUYER. Amendment of its certificate, issued last April 29, covering a 711-mile line from Louisiana to Palmyra, Neb., designed to carry 250 MMcf per day to Northern Natural Gas Co., Omaha, has been submitted by Trunkline Gas Supply Co., Washington, D. C. Because Northern Natural has refused to agree to purchase the gas, Trunkline now wants to build a 740-mile line running from Louisiana to Illinois to serve Panhandle Eastern Pipe Line Co.

EAST TENNESSEE NATURAL'S SHORT LINE APPROVED. Service to Knoxville-Alcoa area will be expedited by an 18-mile line connecting two other lines—the one carrying gas from Tennessee Gas Transmission Co.'s main line to Oak Ridge (due to be completed early this month) and a link with Chattanooga and Knoxville. This will speed service to the latter areas, bringing them gas for the coming winter season.

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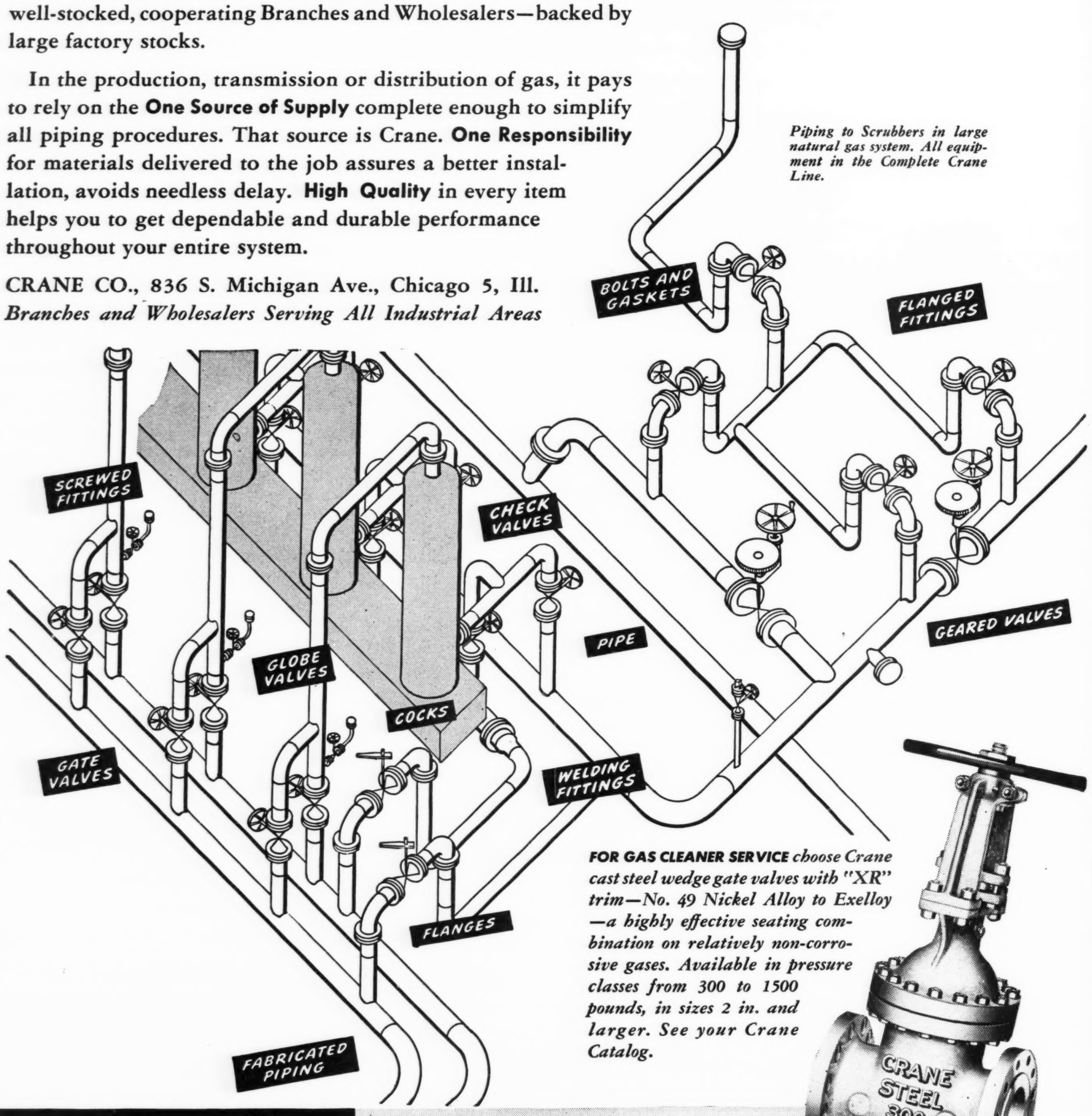

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THERMALLY THINKING

By EDWARD TITUS

leaf by leaf

WILL THE TIME COME when actions of every consumer will be regulated by a federal authority? That is, what kind of breakfast food he eats, what brand of cigarette he smokes what corner store he patronizes, and which refrigerator he purchases?

Probably not. This would be too obvious an encroachment by federal on individual authority.

It might be argued that most of the above items enter into interstate commerce. And so why shouldn't the government tell the consumer, for the good of the country, which breakfast food he's required to eat?

This, however, would be out-dictating the dictators. So it's pretty safe things won't ever come to this pass, although there are those of us who still recall the days of the 18th Amendment, and wonder.

When one gets into the field of business, one runs into something else again. Proprietors of business, even if one counts small business, are a small minority of the voting power of the country. They therefore can be stepped on with more impunity than can a member of a well organized pressure group. A recent issue of the *Saturday Evening Post* included an article by a typical small business man on the dozen (not quite 57) varieties of headaches the government imposes on him in his efforts to serve his local community.

Despite these various government headaches for the small business man, it is doubtful that the government ever will step in and tell the corner delicatessen man that John Jones up the street is smoking too much, so only sell him denicotinized cigarettes, on pain of loss of his privilege of doing business. It's unlikely the government ever will tell the grocer he must deliver more cornflakes to Family A because the doctor has prescribed it for their diet; but don't send any to Family B, because they've gained too much weight and need to cut down on starches (and spend evenings preparing detailed reports on it for the government).

When one gets into larger business operations, like those of utilities, expansion of federal authority is more subtle, and imperceptible to the individual consumer, although it may affect the consumer very importantly.

For instance, in the brief for East Ohio Gas Co., in the hearing before the Supreme Court on the Federal Power Commission's attempt to assume jurisdiction over the company, East Ohio declared that:

"The uncontradicted evidence shows that the cost to East Ohio of attempting to comply with FPC Orders Nos. 69, 69-A, and 73, requiring reclassification and a statement of 'original cost' of *all* of East Ohio's properties—general, distribution, transmission and production—would now be between $1.5 million and $2 million."

The company maintains that the FPC has sought in these proceedings to require East Ohio to spend between $1.5 million and $2 million for "no reasonable or rational purpose."

The brief continues:

"The only conceivable object is to keep the FPC expensively informed as to each detail of each of East Ohio's properties and operations, past and present—" all of which are in Ohio, and on all of which East Ohio now is obligated and does keep the state commission in Ohio informed.

the consumer pays

"All this great additional expense, for no useful purpose," says the company in its brief, "must in the end be borne as a part of the cost of natural gas from East Ohio by its customers in Ohio . . ."

The importance to the customer is thus obvious.

The FPC has been waging a long battle to assume some jurisdiction over East Ohio. The issues have been argued before the Supreme Court and doubtless will be decided by the court before 1950 is far advanced.

The court, not being a legislative body, will rule on the law as it now exists. If it turns out that the court rules that East Ohio does largely or even partly come under jurisdiction of the Federal Power Commission, then Congress should amend the law.

As we read the papers in the case, if the contentions of some counsel in the case are carried out, people in Washington in peacetime could tell East Ohio to serve one town in Ohio and not to serve another Ohio town. The Washingtonians doubtless would graciously refrain from using this power, but it's too much power for them to have in peacetime—similar, but not quite as bad as forcefully telling the grocer one family's diet needs breakfast food and another's doesn't.

Not long ago it was ruled from Washington that gas contracted for in Ohio should go to other states. As we understand it, the powers now sought by the

commission would enable the Washington, rather than the Ohio, authorities to decide between one Ohio community and another.

commissioner miller's analysis

In the thorough study of the subject presented at the recent American Gas Assn. convention in Chicago by Harry M. Miller, president of the National Assn. of Railroad and Utilities Commissioners, Mr. Miller pointed out:

"It is only too well known that Ohio is not the only state affected. The FPC has clearly indicated the distance it proposes to go in extending its jurisdiction over matters heretofore covered by state regulatory authority."

Mr. Miller, a member of the Public Utilities Commission of Ohio, pointed out that in its own petition for certiorari in the East Ohio case, the FPC stated:

"There are now pending before the commission 43 similar cases which involve, as here, transportation in interstate commerce wholly within a single state."

Ohio Commissioner Miller said he was advised that formal proceedings now involve companies doing business in Ohio, Indiana, Iowa, Illinois, Michigan and New York. And, he said, the remaining 35 cases have been subject to commission staff studies, and their identity has not been formally disclosed.

Commissioner Miller asked (in line with one of our statements above):

"Will the FPC in the course of time have the power to say to East Ohio whom it shall and shall not supply natural gas, irrespective of the desires of the municipalities of the State of Ohio and without concurrence of the Public Utilities Commission of Ohio?"

As reported in this space in January of this year, William Tarver, counsel for the FPC, maintained in answer to a question from a judge that even a tiny stub line connecting a local distributing company with an interstate pipeline (no limitation was set as to how tiny) would make the local company subject to federal jurisdiction.

And the current East Ohio brief asserts that the FPC hopes to obtain jurisdiction over every local distributing company in the United States which continues an interstate movement for any distance through a connecting line.

Just think that over. Every distributing company in the United States, large or small, under federal jurisdiction—or almost every one. There might be a few exceptions, but not many. Almost every gas company in the United States, under theory of at least one FPC counsel, would come under federal jurisdiction with whatever headaches and expense might be involved. That's because nearly every one will be receiving natural gas from an interstate pipeline.

new york, too

Take the City of New York, with its five boroughs, Manhattan, the Bronx, Brooklyn, Queens, and Richmond.

An inconspicuous item of a few paragraphs, dropped down into the New York financial sections, disclosed a little while ago that the Federal Power Commission had decided it had jurisdiction over the large New York companies, Consolidated Edison, The Brooklyn Union Gas Co., and Kings County Lighting. The commission had reversed the finding of its chief examiner, and there was only one dissent, that of Commissioner Draper—surprising to some, but he made his position clear in a later statement.

The issue over New York jurisdiction is complicated but important. The three companies mentioned above, and other New York companies, last year entered into a "New York Facilities Agreement." This was to provide for construction, operation, and maintenance of the facilities for distribution of gas delivered to each buyer by Transcontinental (the interstate transporter of the gas), and for apportioning of costs among themselves.

The commission's conclusion is that the New York companies, when they have finished their construction for distributing the natural gas and have their facilities in operation under the agreement "will be engaged in the business of transportation of natural gas in interstate commerce for compensation."

And this despite the fact that all the companies operate entirely within the State of New York and, in fact, within the city of New York.

The New York companies are asking for a rehearing of the case before the FPC and, if this is not granted, are expected to take it to the courts.

The New York case is closely allied in some ways, but not all, with that of East Ohio. Very likely the FPC will delay any decision on the application for rehearing until the Supreme Court has acted in the East Ohio case.

As Commissioner Miller of Ohio put it at the AGA convention:

"In due course the Supreme Court of the United States will announce to us what the Congress intended. In the meantime, and at all times, it is the right of every state and of every citizen to seek by judicial interpretation, by petition to their representatives in Congress, and by the ballot itself, the retention, and if necessary, the restoration of the rights and privileges they believe should *not* be exercised by a central government."

In other words, don't let American local liberty be gobbled up inconspicuously and leaf by leaf, like an artichoke.

let's talk about things

Regardless of the justice or the injustice of the claims of those who favor respectively expansion of federal power over regulation and, on the other hand, those who favor retention or enlargement of state powers—here is a matter that utility managements cannot effectively meet by sitting about and debating in board rooms, although that may be a necessary first step.

The only way to inform employees and inform stockholders is to inform them.

If a former FPC commissioner, lately unconfirmed by the Senate for reappointment, is privileged to express himself, under the American system of free speech, in somewhat unrestrained fashion in a couple of dailies, certainly the industry should be privileged to discuss national problems with relative impartiality in company house organs and in statements to stockholders.

It is significant that a statement which meant the federal government was announcing it would take regulatory jurisdiction over about all the gas distributing companies in the largest city in the country got only a few paragraphs in the New York financial sections. Leaf by leaf and unnoticed local liberties disappear.

The people in Washington who write news dispatches for the financial sections that stockholders read are hard-pressed deadline fighters and don't have time to analyze.

It's up to management to fill the gap and give stockholders and employees the fill-in information. Surveys have indicated management is giving stockholders the information management thinks it wants to give them, not what stockholders want.

There are plenty of things for the gas industry to talk about. There's the Washington picture, and many important constructive things about industry progress. Perhaps stockholders and employees also would like to hear both the FPC staff side of the picture, and some extracts from the talk of Commissioner Miller of Ohio, going 'way back into what the American system is all about.

TECHNICAL TRENDS

by Guy Corfield

gas from the ocean bottom

ELSEWHERE IN THIS ISSUE is a two-part symposium, "Natural Gas From the Tidelands" (p. 79), discussing production of natural gas from the tidelands or off-shore areas. This relatively recent development, aside from its major implication of the existence of vast new reserves of natural gas and oil, has many interesting ramifications. Technically and mechanically, there will be many problems to solve in both production and transmission. Legally, there is still complete confusion in that the ownership of these tidelands and off-shore areas is in dispute between the federal government and the various maritime states with present judicial decisions merely heightening the uncertainty.

A California newspaper recently reported an approach which, if not new, at least has not received attention in any publications which have come to our attention. It does not seem to be an illogical extension of marine ownership and exploration activity, but it does appear to still further complicate the technical and particularly the legal problems, and even invite international complications.

This report stated that H. A. Hansen, a Long Beach (Calif.) mining engineer and geologist, has filed a pre-emption claim to a 5000-square mile triangle of *ocean bottom* off the California-Mexico coast, which he states is outside the disputed tidelands area and beyond the 100-fathom line (a fathom is 6 ft)—and, presumably, beyond the normal jurisdiction of any authority within the United States or elsewhere, as he further states that it will be necessary for the President to proclaim jurisdiction over the area and then to recognize his claim and thus make it "official." Mr. Hansen asserts that this area includes seven separate potential oil fields which may contain as much as 2 billion bbls of oil, and he is prepared to exploit it by use of new caisson and tunneling techniques on which he holds patents.

homogeneous carburizing

THE ORDINARY CONCEPT of carburizing is the addition of carbon to the surface of a finished mild steel product. The purpose is to give surface hardness, and the depth of penetration of the added carbon is relatively slight. When it is necessary for a finished steel part to consist entirely of medium or high carbon stock, forming and shaping of this stock are difficult and critical because of hardness and tendency to crack, and decarburization may take place during annealing.

Suface Combustion Corp. has recently described a process, called homogeneous carburizing, whereby carbon is added to and distributed evenly throughout the metal, to any desired content, which makes it possible to fabricate steel parts from low carbon steel stock and then convert them to medium or high carbon steel. The advantages of this technique, for certain production processes, seem obvious.

In normal gas carburizing, the metal is surrounded by an atmosphere very high in carbon, and the time and temperature are adjusted to permit the desired degree of absorption by the metal so that a high carbon content is built up at the surface but the amount or distance of penetration is relatively slight. Homogeneous carburizing differs from this in that the composition and temperature of the atmosphere surrounding the metal are adjusted to produce an *equilibrium* carbon content in the steel, of desired amount. The carbon penetrates slowly into the steel until the equilibrium composition is reached, and then there will be no further absorption even at the surface no matter how much longer the treatment is continued. Thus it is possible to treat uniformly a shape of varying thickness.

This type of treatment can be carried out in either batch or continuous furnaces, supplied with appropriate atmospheres from generators using various hydrocarbon gases. When natural gas is used, the atmosphere will consist of approximately 20% carbon monoxide, 40% hydrogen, 40% nitrogen and necessary amounts of carbon dioxide and water vapor. Carbon content in the treated steel can be developed to any level between 0.10 to 1.00% or even higher. From a practical standpoint, applicability is limited by the time required for treatment. One-sixteenth-inch thick steel can be raised to any desired carbon content with about seven hours treatment at 1700° F. In some instances it may be found economical to treat steel as thick as 1/8th in. There may be applications, also, where it is not necessary or even desirable to continue the treatment to complete uniformity, but rather to finish with carbon content gradually diminishing between the outer surface and the center of the metal.

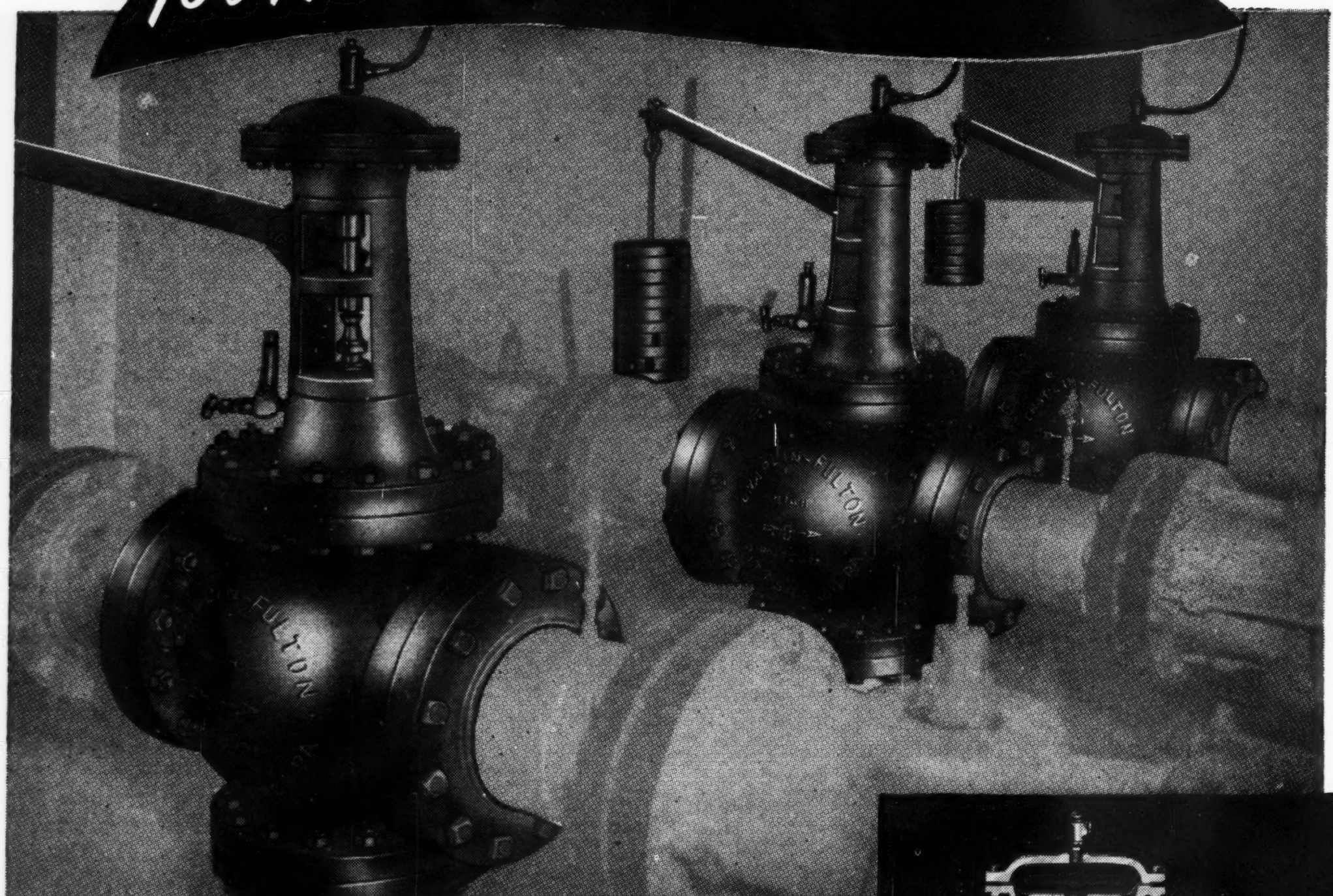
lightning protection for tanks

RECENTLY AN INQUIRY WAS RECEIVED by BUTANE-PROPANE *News*, our affiliated publication, as to current practice in protecting LP-Gas storage tanks against lightning.

It appears that a widely used method is to ground each tank by a permanently attached heavy copper wire connected to a substantial and deep-driven ground rod. The relief valve stacks or risers, as conventionally installed, are considered to be adequate as lightning rods.

Assertedly cases have been known where lightning has struck the risers of tanks so equipped, without any indication of damage to the tank or fittings.

For New —



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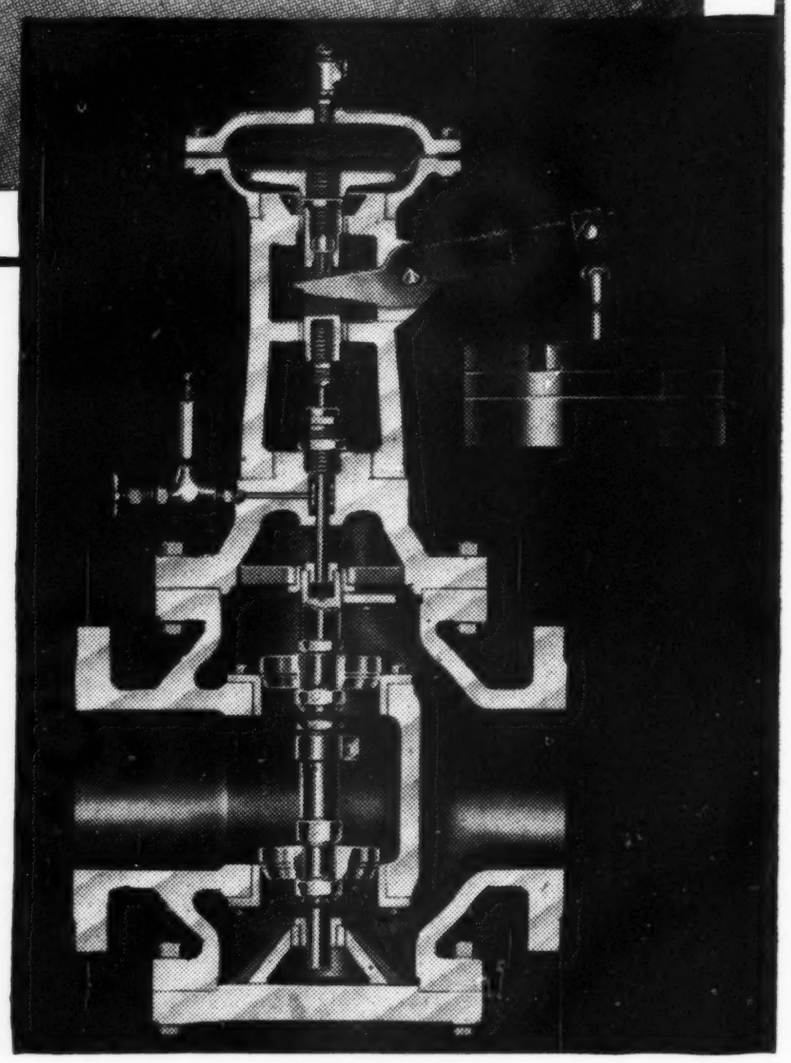

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PROMOTIONAL NOTES AND NOTIONS

by Stanley Jenks

television and gas promotion

THERE SEEMS LITTLE DOUBT that television is here to stay. In those metropolitan areas where the 75 telecasting stations are operating, one of the real post-war miracles is the number of television antennae sprouting on the roofs. The U. S. Department of Commerce states there were 97 manufacturers of television sets and kits during 1948, who produced an estimated total of 975,000 units last year. The Radio Manufacturers Assn. estimated a production of 2 million television sets during 1949. This total unquestionably will be excelled by at least 500,000 sets. The Department of Commerce estimates there were 1,860,000 sets in use as of July 31, 1949.

So far, the distribution is compressed into metropolitan areas within a range of 50-75 miles of the station, but, as more stations are built—42 are under construction—the audience spreads too. As a television set owner, I am satisfied that the television medium is far superior to radio. Our radios at home are never turned on these days. The television set is the social center of the household. Maybe you can shut your ears to radio commercials, but it is well nigh impossible to shut your eyes and ears to the ingenious and diverting television commercials they have these days. The tragedy is, the gas industry gets little, if any, play. Currently, there are several electric ranges being glamorized and glorified over television. The only gas range mention I have heard was on a give-away show. It was one of the items of an umpteen thousand dollar prize if you identified by phone a tinkling tune like "Swanee River" or such like.

Furthermore, being happily married, I listen occasionally to television cookery programs, when they don't conflict with the fights or a ball game. I have yet to see a gas range or a gas refrigerator used in the studio kitchen, or hear a lecturer specifically mention gas cooking.

It seems to me, with such an important audience right under our noses, we are letting our electric competitors get away with murder.

After all, gas cooking and refrigeration service is still as modern as tomorrow's television set can hope to be, and we should be there—right in the picture—to prove it.

relative costs

WHILE ONE COULD ANTICIPATE without even a crystal ball that the kilowatt kids would be pushing their relative thermal efficiency story beyond the limits of accuracy, it seems to me that the real issue is relative costs of operation. The customer wants to know—if cost is a factor—whether it costs more to cook, heat water, or refrigerate with gas than with electricity. Mind you, this completely overlooks all the other marked advantages of gas, such as lower initial investment; speed and greater flexibility in the cooking and water heating fields; and reliability and durability in the refrigeration field.

The fact is, there are 3413 Btu's in a kilowatt-hour. All the kilowatt-houris who ever cavorted bewitchingly on Fred Waring's electrically sponsored TV show, however "hot," cannot add another heat unit to a kilowatt-hour. These 3413 Btu's cost *X* cents. Granting the electric lads their 100% thermal efficiency—and we are being absurdly generous—it is simply a question of how many gas Btu's will get the same results, and how much they cost.

This relative thermal efficiency business is a smoke screen to hide the fundamental weakness of the electric pretensions in the cooking and water heating fields especially. The facts are that steam-generated electricity cannot begin to take the Btu's in a pound of coal, absorb the line losses, and deliver them to the point of use in the customer's home at a comparable price with gas service. Hence, this utilization mumbo-jumbo to confuse the issue.

eagle eye on arcadia

WITH SOCIALISTIC SHADOWS forever lengthening in Washington, it's a pretty good idea to keep an eagle eye on what is happening elsewhere in these socialistic arcadias.

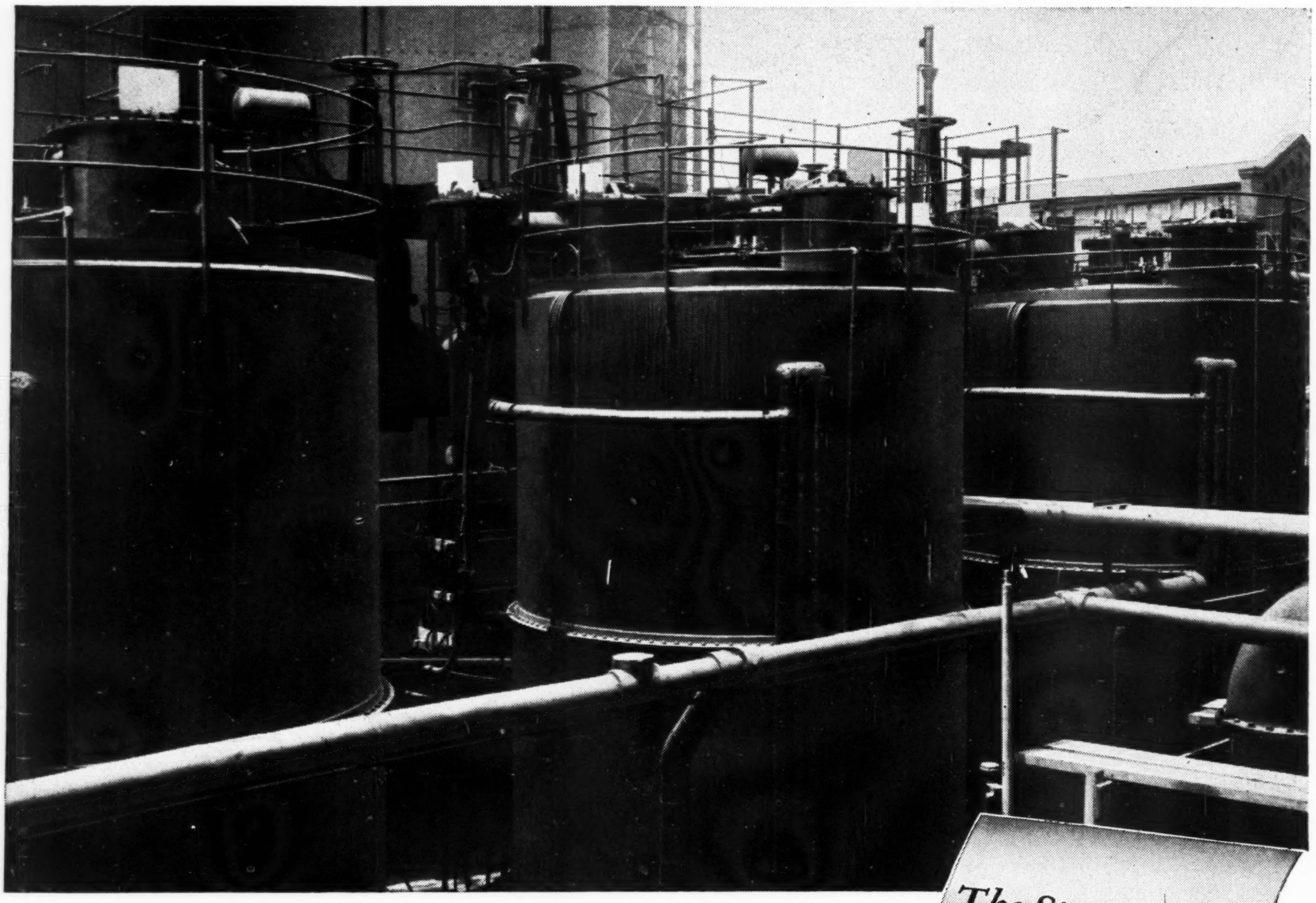
The British government, avowedly socialistic, nationalized some of its so-called basic industries, including coal mining, transportation, and the electric and gas utilities. It is no secret that prices of the nationalized commodities or services have been increased, or the industries themselves have taken big losses at the general taxpayers' expense.

A recent report from Britain reveals another unhappy condition, which uncovers a situation that can be a lesson and a warning to us.

In brief, private British electric contractors, through their national association, have justly raised an unholy rumpus against the unfair contracting activities of the British Electricity Authority, which runs the nationalized electric utility industry. The contractors' association has charged and proved that the BEA (1) had been undertaking installation work at less than the actual labor and material cost, (2) selling equipment and appliances on terms unavailable to the contractor-dealers, and (3) in some instances actually intimidating people by denying service unless the installation was done by BEA.

It must be admitted that such a situation, in a more or less modified degree, used to exist with us in the old days when we were pioneering for load to justify our economic existence. Maybe it still exists in some isolated instances, where merchandising compensation pressure drives to uneconomic lengths, and "dealer-be-damned" still rules.

On the whole, however, we appreciate the value of our dealers in our promotional activities. We recognize that the more people we have engaged profitably in the gas business, the stronger we are and the better able we are to rally our friends at the local level to fight the socialistic menace of nationalization from on high.



The Story Behind
KOPPERS-ELEX
Performance
GUARANTEE

KOPPERS-ELEX PRECIPITATORS RECOVER MORE TAR THAN SPECIFIED!

FOR maximum refinement of manufactured gas, therefore maximum recovery of valuable by-products, the management of a public utility specified the Koppers-Elex precipitators shown in this installation.

Designed to handle 96,000,000 cubic feet of gas per day and with guaranteed removal efficiency of 95% of the .5 gr./c.f. tar entrainment, under normal operating conditions, the precipitators actually treated 144,000,000 cubic feet of gas per day! *Actual efficiency* was from *98.75%* to *99.25%* with tar entrainment of 1.2 to 1.9 grains per cubic foot, far exceeding the guaranteed performance!

This performance is typical of Koppers-Elex precipitators because correct design and precision engineering, coupled with the experience gained from over 1000 successful installations, give superior results in the recovery or removal of materials from gasses. Specify Koppers-Elex . . . designed, engineered, built, installed and guaranteed by Koppers . . . *with 111 years of reputation-building integrity behind it.* Koppers Co., Inc., Koppers-Elex Precipitator Dept., 222 Scott St., Baltimore 3, Maryland.

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ELECTROSTATIC PRECIPITATOR
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USING NATURAL GAS

in a manufactured gas system

Problems of production, distribution and utilization--Part I of two parts.

By E. G. BOYER

THE use of natural gas as a material in the production of a suitable gas for distribution to customers in a territory previously supplied by a combination of coke oven gas, water gas, and reformed refinery oil gas has many advantages and some disadvantages.

Among the more important advantages are reasonably uniform heating value and specific gravity, freedom from hydrogen sulphide, improved reliability of supply, versatility of use for enriching, reforming, catalytic cracking, boiler fuel, compressor engine fuel, delivery under high pressure, low cost when used at a high load factor, and ease of control and handling.

Some of the disadvantages are the relatively slow burning characteristic of natural gas, the lack of condensible oils to moisten pipe joints, the high cost of the gas when used at a low load factor, and the difficulty of manufacturing a substitute gas that is as slow burning as natural gas.

Philadelphia Electric Co. endeavors to make the best use of the advantageous qualities of natural gas and circumvent its weaknesses in production, distribution, and utilization in a manufactured gas system. This article describes the company's efforts.

The present maximum sendout of 110 MMcf of 520-Btu gas is manufactured in two major plants, one at West Conshohocken and the other at Chester. These two plants, 18 miles apart, are connected by transmission mains but, because of conditions that will be explained later, they normally serve separate territories of varying specific gravities.

The West Conshohocken plant handles a maximum of 17.5 MMcf per day of purchased coke oven gas, has a production capacity for 10 MMcf per day of carburetted water gas or blue gas, 12 MMcf per day of producer gas, 12 MMcf per day of 700-Btu LP-Gas-air from a 500,000-gal propane storage plant equipped with jet compressors, and 20 MMcf per day of natural gas-air jet capacity in addition to natural gas enriching facilities. The maximum quantity of natural gas available at this plant is 15 MMcf per day. The storage holder capacity is 15 MMcf.

The Chester plant produces 5 MMcf per day of coke oven gas, contains six mechanical generator water gas-reformed gas sets, one high-Btu oil gas set, 15 MMcf per day of 520-Btu LP-Gas-air jet capacity with 250,000 gals of propane storage, 10 MMcf of natural gas-air jet capacity, a maximum supply of 120,000 therms per day of refinery oil gas, and 5000 to 15,000 Mcf per day of natural gas—depending upon the quantity required at West Conshohocken. Under the terms of our natural gas contract, the company receives a maximum of 20,000 Mcf per day, not more than 15,000 Mcf of which may be taken at either plant. The storage holder capacity is 13 MMcf.

Load forecasts indicate that our maximum day will increase from 110 MMcf to 170 MMcf in the next five years. In order to meet this increased sendout, we have contracted with Transcontinental Gas Pipe Line Corp. for an

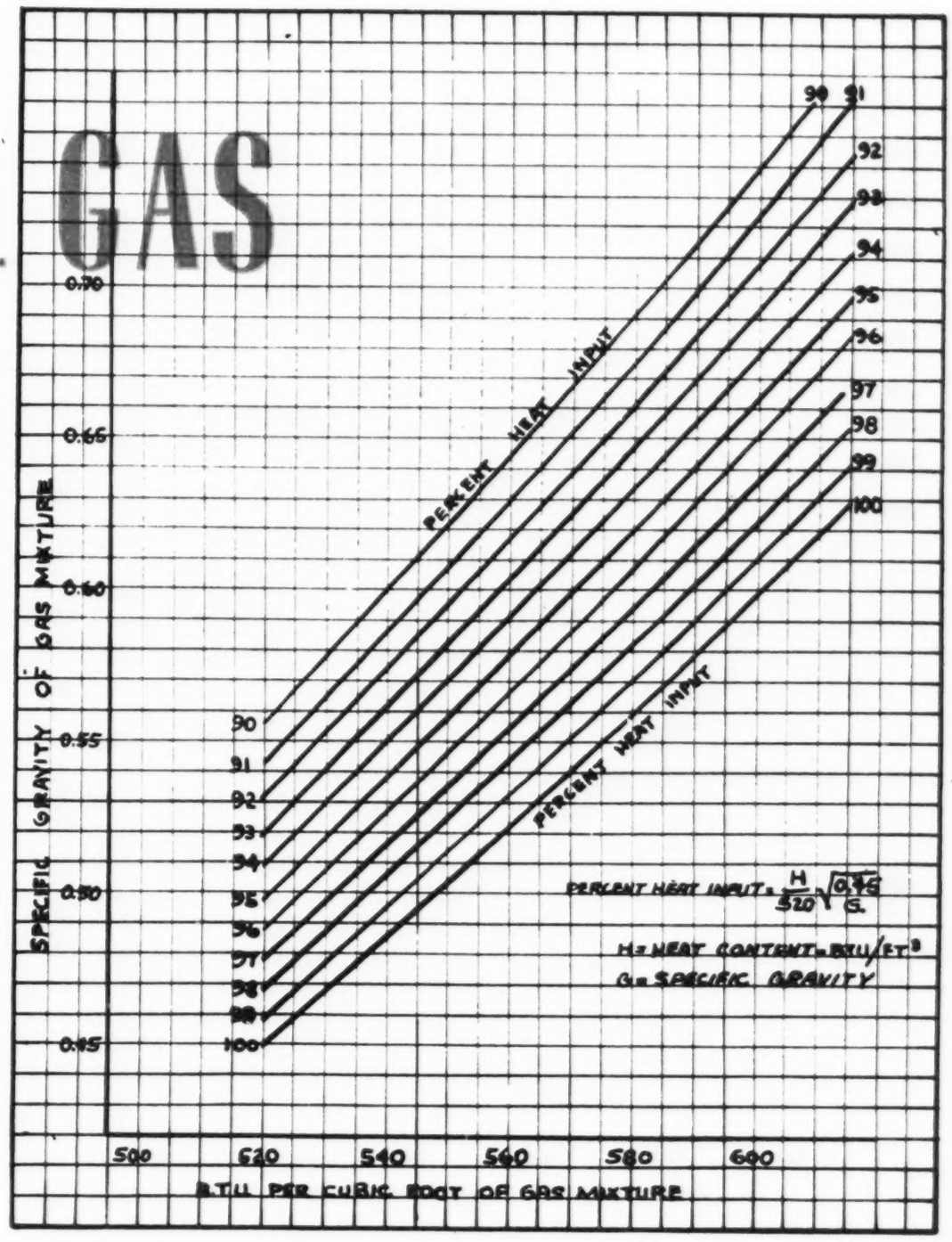


Fig. 1. Constant per cent heat input curves, low gravity area.

The experiences of the Philadelphia Electric Co. in using natural gas as a material in a manufactured gas system may serve as a blueprint for other companies faced with the inherent difficulties of changeover and mixing. This article, first presented before the New Jersey Gas Assn. meeting at Spring Lake, N. J., Sept. 9, was one part of a three-part symposium on the subject. Because of its extreme length it has been divided into two parts for GAS' readers; in this, the first part, the author discusses the company system, its control and operation and difficulties encountered. In the second installment, to appear next month, he discusses the advantages and disadvantages of natural gas under such conditions, and how the company has tried to utilize it accordingly.

Mr. Boyer, manager of the gas department of the Philadelphia utility, needs no introduction to gasmen. His most recent honor was the winning of the Beal medal, presented at the AGA convention in October in recognition of his paper, "Meeting the Peak Load Problem," adjudged the year's best.

additional 30 MMcf per day of natural gas to be supplied to the two plants, starting when the line from Texas is completed late next year or early in 1951. This will make a total of 50 MMcf of natural gas available for our system. It may be necessary to install a catalytic cracking plant at West Conshohocken in order to be able to manufacture a suitable gas the year around from an interchangeability standpoint. In the catalytic plant natural gas would be cracked to produce a carrier gas, or liquefied petroleum gas could be substituted for the natural gas during peak load or emergency operation.

The method of operating the plants in order to supply the required quantity of gas of a suitable quality in each territory at the lowest possible production cost is continually being studied and improved as conditions change and experience dictates. A central system operating group controls the use of raw materials and the quantities of gas to be manufactured. The gas system operating group notifies the plants of the forecasted quantities of gas that will be required to meet the sendout each day; and, by the use of interchangeability charts and tables, the approximate quantities of different types of gases that should be produced. A description of the development and use of the interchangeability charts and tables will be given later. A description of the natural gas flow and control procedure in each of our plants will now be given.

Natural gas at Chester is used for enriching, for jet operation to produce 520-Btu natural gas-air, for reforming, and for compressor fuel and boiler fuel.

Tilgham Street Flow

Following the flow for the Tilgham street plant, the natural gas enters the Texas Eastern Transmission Corp.'s metering station at 200 to 600 psi. It is reduced in pressure to 100 psi and then passes through the multiple metering runs. The differential on the metering orifices is used to operate the billing meters and to operate flow controllers. The flow controllers are set to limit the quantity of gas passing the metering point to that portion of the contract quantity which is allocated by the system operating group to Chester.

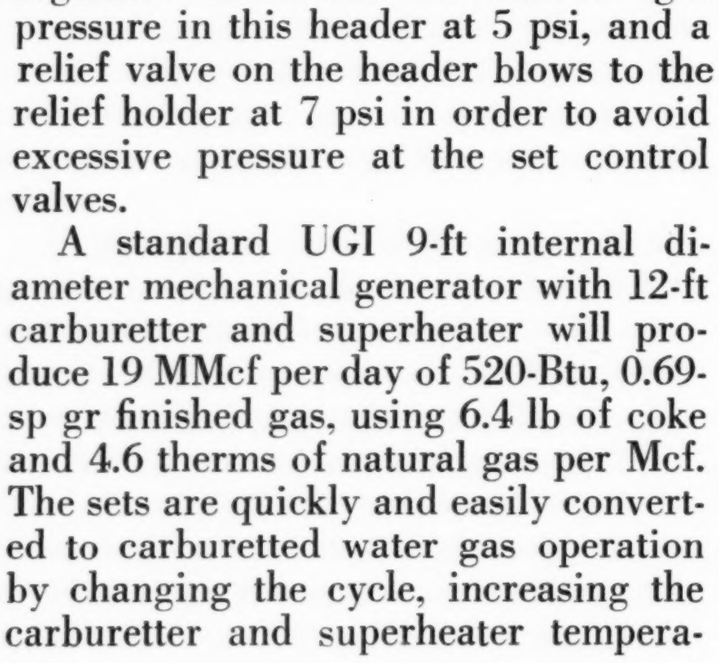
An atmospheric relief valve, set to blow at 130 psi, protects the line to the plant and the plant facilities from excess pressure in case of a regulator failure. An alcohol injection system is provided to alleviate freezing in the pressure regulating valves and flow control valves. Freezing, as a result of a single-step pressure reduction, from 500 to 100 psi, occurred frequently last winter, requiring almost continuous use of alcohol. It is expected that line dehydration during the summer and the installation of a pressure reduction station about 30 miles ahead of this metering station will eliminate the freezing difficulties.

Quantity Check

The natural gas is delivered to the plant through 6000 feet of 12-in. main. An orifice meter, a Cutler-Hammer recording calorimeter, a recording thermometer, a recording pressure gage, and a recording gravitometer provides the information necessary for calculating the quantity of gas received at the plant as a check against the Texas Eastern Transmission Corp.'s billing. A Robinson orifice fitting is used to hold the meter orifice so that the orifice can be inspected or changed in size without interrupting the flow of gas.

After metering, part of the gas is reduced in pressure to 40 psi for distribution to its various points of use throughout the manufacturing and transmission plants. If only a small amount of natural gas is available for reforming, it is mixed in the high pressure (50 psi) bullet holder with the incoming refinery oil gas to be used for reforming. If sufficient natural gas is available to operate one or more sets on reforming, segregating valves in the gaseous hydrocarbon supply header to the six sets are operated to supply natural gas to as many sets as desired, and refinery oil gas to the others. A regulator maintains the natural gas pressure in this header at 5 psi, and a relief valve on the header blows to the relief holder at 7 psi in order to avoid excessive pressure at the set control valves.

A standard UGI 9-ft internal diameter mechanical generator with 12-ft carburetter and superheater will produce 19 MMcf per day of 520-Btu, 0.69-sp gr finished gas, using 6.4 lb of coke and 4.6 therms of natural gas per Mcf. The sets are quickly and easily converted to carburetted water gas operation by changing the cycle, increasing the carburetter and superheater temperatures, shutting off the natural gas, and turning on the oil supply.



A twin-generator high-Btu oil gas set is operated when needed, the gas from this set mixing with the reformed gas and water gas at the inlet to the relief holder.

After scrubbing the gas, purification air is added. The gas is metered, mixed with coke oven gas, then purified in dry boxes. When refinery oil gas is used for enriching it is added before the gas is metered.

Natural gas from the plant metering station at 100 psi pressure is delivered to jet compressors which produce a 520-Btu natural gas-air mixture under sufficient pressure to deliver it into the manufactured gas line to the 10 MMcf storage holder. Propane-air jets are provided at this same location for use when required.

Natural Gas Enriching

Natural gas enriching is provided at the holder inlet for final Btu control. The natural gas is reduced in pressure to 8 psi before passing through the butterfly control valve of a Cutler-Hammer calorimixer. The calorimixer is a fast responding calorimeter which measures the approximate heating value of the mixed gases entering the holder and adjusts the quantity of natural gas for enriching to maintain the heating value for which the calorimixer is set. A Cutler-Hammer calorimeter records the heating value of the holder inlet gas and at the same time supervises the setting of the calorimixer so as to produce the desired holder inlet heating value. The mixing of the gas in the holder evens out the small variations in the holder inlet Btu, resulting in a uniform holder outlet Btu.

Natural Gas Uses

The specific gravity of the holder inlet gas is recorded. Close manual control of this specific gravity is obtained by varying the percentage of blow-run (products of combustion from the heating portion of the set cycle that are added to the gas) on sets to take care of variations in the relative quantities of reformed gas, coke oven gas, high-Btu oil gas, jet-gas, etc., that are being produced.

In addition to these gas-making uses, natural gas from the 40-psi plant line is used for gas engine compressor fuel and, when available, for steam plant boiler fuel. Refinery oil gas is also available for these two uses.

An orifice-type flowmeter is provided for measuring the amount of natural gas used for each of the five purposes described. The sum of the usage on the individual meters usually checks the

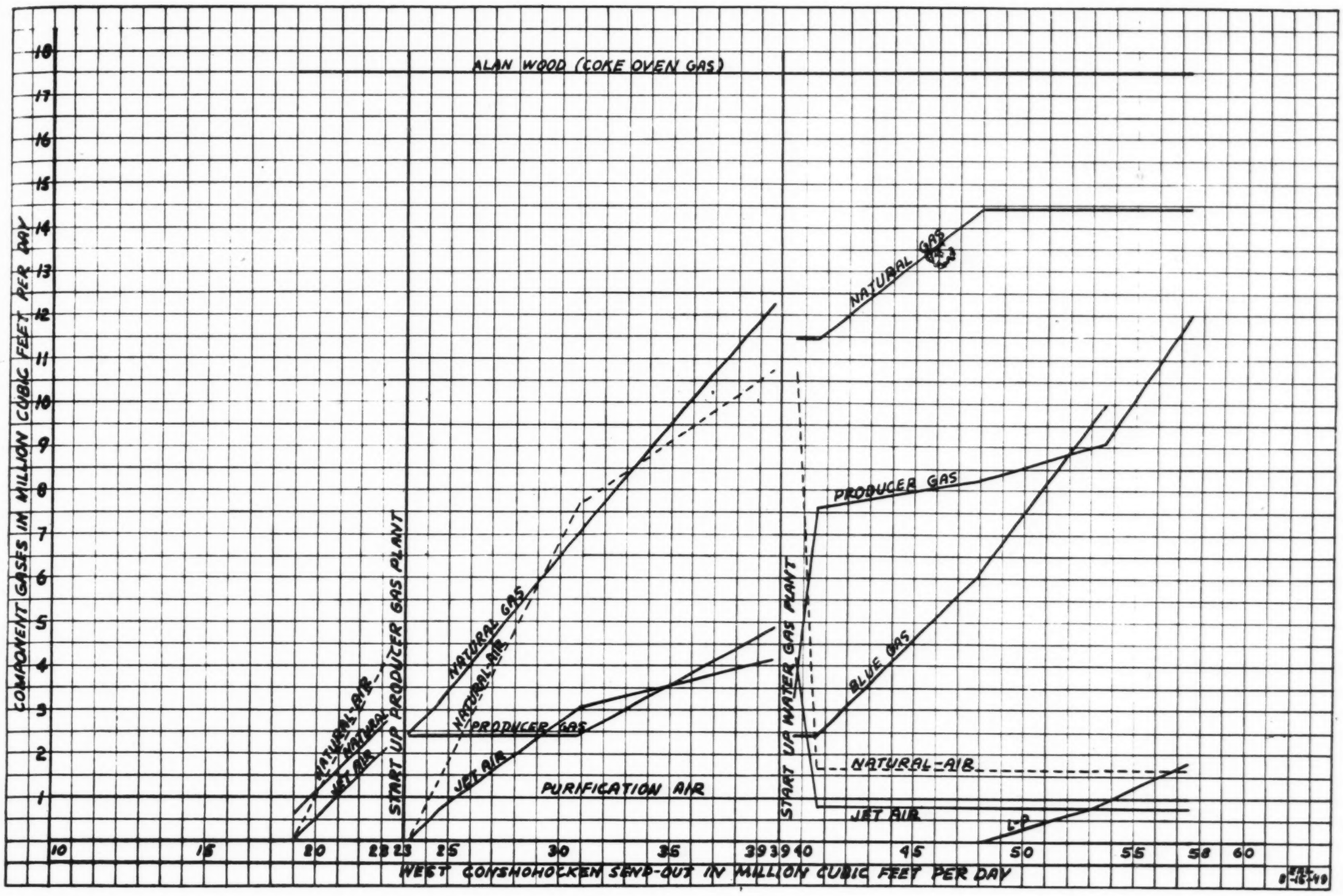


Fig. 2. Production schedule, West Conshohocken gas plant (50,000 therms of natural gas available). All mixtures at minimum heat input of 95% and maximum oxygen content of 2.8%.

total plant meter to within 2%.

The fluctuation in the flow on the orifice meters, caused by the 4-minute cyclic operation when reforming natural gas, will make it practically impossible to determine the correct flow unless a well controlled surge tank of adequate capacity is used. Our bullet holder of 300 Mcf capacity at 50 psi makes a good surge tank.

Dust, particularly in new natural gas lines, destroys leather regulator seats very quickly. A tough synthetic rubber for these seats lasts very well and helps prevent excessive pressures from leaky regulators. Regulator leakage should be checked frequently, particularly during the first few days or weeks of operation on a new line.

West Conshohocken Flow

Natural gas is used at West Conshohocken for enriching producer gas, blue gas, and carburetted water gas; for the operation of natural gas-air jets, for enriching to control heating value, and for fuel for gas engine compressors and boilers.

In the West Conshohocken plant flow, the natural gas is supplied from a metering station similar to the Chester metering station, but located in the plant. Part of the natural gas is used to enrich a mixture of coke oven gas, purification air, and blue gas when it is being produced. The natural gas flow is controlled by a calorimixer-calorimeter system similar to the one at Chester. After dry box purification, this mixture of manufactured gas enriched with natural gas normally goes to the low gravity mixing tank where natural gas-air from jets, purified producer gas, and natural gas for enriching are added. The amount of enriching is controlled by another calorimixer-calorimeter system. This finished gas is then stored in the 10 MMcf low-gravity holder or it can be delivered to the high-gravity mixing tank.

During peak load periods, it is necessary for the West Conshohocken plant to supply a suitable gas for distribution to part of the high gravity area normally supplied by Chester. In order to do this, we will install a high gravity mixing tank with inlet connections from the producer gas purifiers, from the outlet of the low gravity mixing tank, from natural gas-air jets, from an air blower, and from natural gas for enriching. As will be explained later, the heating value of the low-gravity gas will be above 520 Btu during peak load periods. It is planned to add air to this low-gravity gas to reduce its heating value and increase its specific gravity to those values required for the high gravity area. Producer gas, or blue gas, can be used in place of air if it is so desired; and natural gas enriching will be used for final heating value control. Connections are provided to permit the use of Chester gas in both mixing tanks.

Dry Gas

The introduction of natural gas for enriching and natural gas-air into the 520-Btu, 0.69-sp gr mixture of coke oven gas, reformed refinery oil gas, carburetted water gas, and high-Btu oil gas has caused very few distribution and utilization problems in the area served by the Chester plant.

The gas distributed in this system has been relatively dry in respect to condensible oils since reformed refinery oil gas was substituted for carburetted water gas in 1929. Some localized dust troubles are encountered each fall when increased sendout raises the gas velocity in the mains, but it has been of a minor nature. Practically no trouble has been experienced from the drying-out of yarn in low pressure joints. Some medium pressure cast-iron line joints have required leak clamping to eliminate leakage which might have been caused by the relatively dry reformed refinery oil gas, but there has been no increase

in this leakage condition since the introduction of natural gas a year ago.

The use of natural gas for enriching and natural gas-air in the West Conshohocken low-gravity area, where straight coke oven gas with peak-load water gas was the normal condition, has caused no noticeable trouble in the distribution system. The sendout gas has contained a maximum of 3% oxygen and 25% natural gas at times of peak production.

As the mixing of various types of gases has increased, it has become more evident that heating value and specific gravity are not the only factors governing the satisfactory operation of customers' appliances. The burning characteristics of the various gases must be taken into consideration if the best results are to be obtained. Though there are various formulae and test burners to indicate burning characteristics or interchangeability, these have not been considered reliable enough for our operating purposes.

Another Variable

The use of natural gas at West Conshohocken has added another variable to an existing interchangeability problem. Prior to 1946, the heating value of the sendout gas was kept at 520 Btu and the specific gravity was held to a maximum of 0.52. The gas composition at that time varied from straight coke oven gas during the summer, with its heating value adjusted to 520 Btu with air, to a mixture of coke oven gas, reformed refinery oil gas from the Chester plant, and carburetted water gas during the winter load.

By 1946, the load had increased to such an extent that it was no longer possible to keep the specific gravity below 0.52 during the heating season. The quantity of coke oven gas was fixed; gas from the Chester plant and carburetted water gas were high gravity gases, and the production of very high-gravity butane-air was started.

The increase in specific gravity may be compensated for by increasing the Btu of the gas. This compensation was first carried out according to the Knoy Formula. Subsequent laboratory data and operating experience have resulted in establishing our operation according to heat input. When the specific gravity of the gas exceeds 0.50, the Btu is increased to supply 95% of the heat input that would be supplied by a gas of 520 Btu, 0.45 sp gr. Steps are also being taken to establish a minimum specific gravity of 0.48 when the gas sent out is at the Btu minimum of 520. This close control of heat input was adopted primarily for better utilization of gas by our customers.

Fig. 1 shows per cent heat input in our low gravity area as a function of

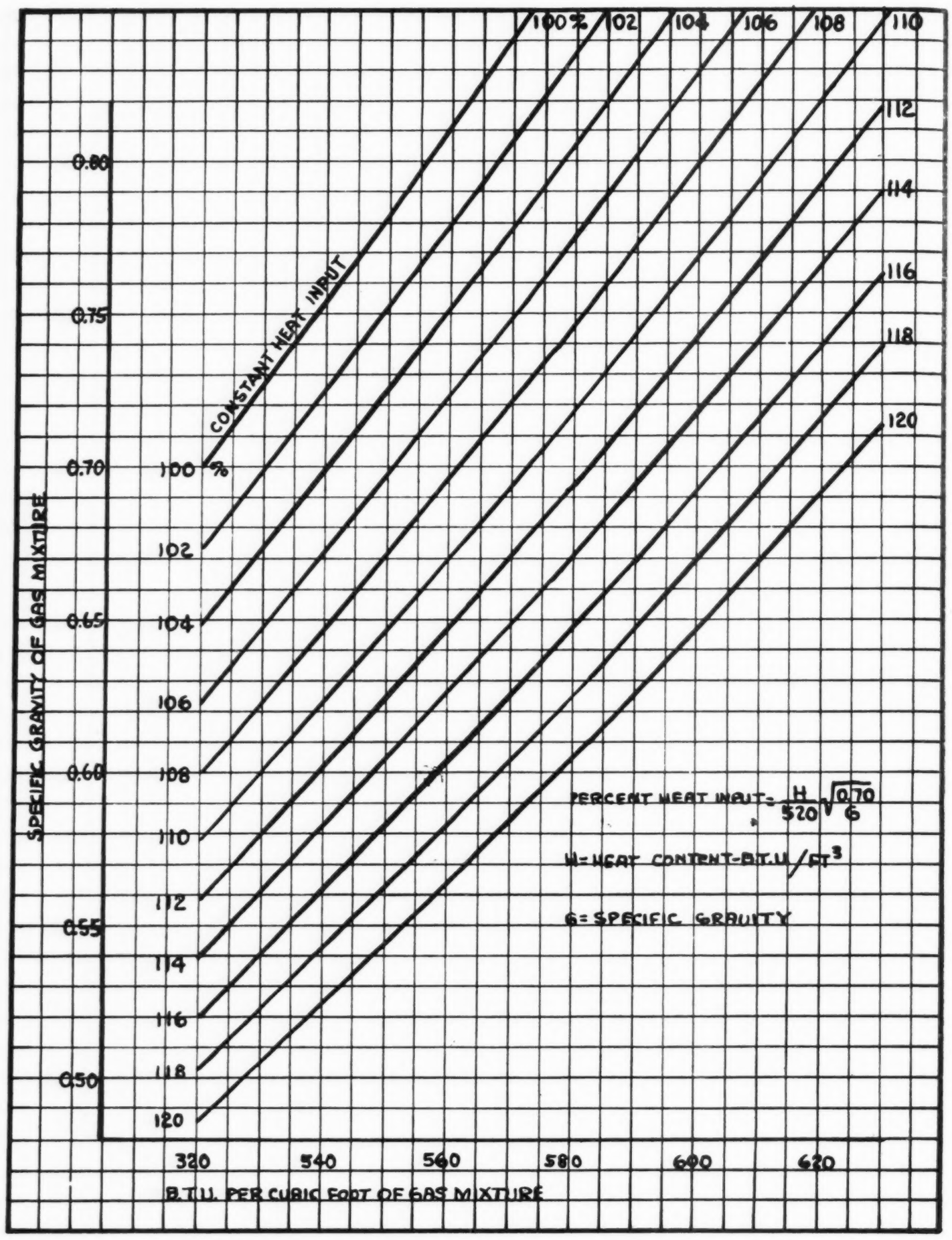


Fig. 3. Constant per cent heat input curves, high gravity area.

Btu and specific gravity. Using a 520-Btu, 0.45-sp gr gas as the base gas giving 100% heat input, the heat input would drop to 90.5% if the specific gravity were raised to 0.55 with the heating value at 520 Btu. With the specific gravity at 0.55, raising the heating value to 547 Btu would increase the heat input to 95%. It would require 576 Btu to supply 100% heat input at 0.55 sp gr. An increase in the heating value of the gas above 520 Btu results in a loss of revenue and increases the production cost of gas per Mcf.

We have found it unnecessary to supply 100% heat input, as 95% has given complete customer satisfaction. During a test period on a 92% and 93% heat input curve, some customers noticed slow heating.

In addition to providing good appliance operation, increasing the heating value to maintain 95% heat input increases holder, transmission pumping, and main capacities during peak load periods.

Interchangeability Musts

Establishing the proper Btu-to-specific gravity relationship is but one of the requirements necessary for gas interchangeability. Flash-back, lifting or blow-off, and yellow tip must be avoided on the burners. In the operation at West Conshohocken, the supplementary gases have been slower burning than the coke oven gas; thus the control of flash-back has been no problem. By following the 95% heat input relationship between Btu and specfic gravity, there have been no yellow tips on gas mixtures that were otherwise satisfactory.

In order to obtain better control of interchangeability, a testing laboratory was set up in the plant. An assortment of 18 burners and pilots, chosen as representative of critical burners, was in-

stalled and properly adjusted for a base gas of 520 Btu, 0.45 sp gr. The various gas mixtures that the plant was likely to produce were tested on these burners and limits were established for the quantities of various combinations which were satisfactory.

The following mixtures shown in *Table 1* were found to be interchangeable with a 520-Btu 0.45-sp gr base gas composed of approximately 85% coke oven gas and 15% natural gas-air. The Btu of the supplement gas must be such that after mixing, the Btu and specific gravity of the mixture will supply 95% of the heat input supplied by the base gas.

TABLE 1. MIXTURES INTERCHANGEABLE WITH BASE GAS

Supplement	Minimum % of coke oven gas which must be added to the supplement gas
Natural gas-air	48%
Natural gas-producer gas	40%
LP-Gas-air	60%
LP-Gas-producer gas	55%
Natural gas-blue gas	0
Mixture of: 75% natural gas-blue gas 25% natural gas-air or natural gas-producer gas	0
LP-Gas-blue gas	0
Mixture of: 80% Lp-Gas-blue gas 20% LP-Gas-air	0
Mixture of: 75% LP-Gas-blue gas 25% LP-Gas-producer gas	0

Graph Devised

To simplify this arrangement of interchangeable mixtures, a graph was developed from which may be read the volumes of component gases required to make up the sendout, from minimum load to peak load. This chart is so designed that the mixtures taken from it will be interchangeable at 95% heat input when the specific gravity is above 0.50, and contains a maximum of 2.8% oxygen. This chart is shown in *Fig. 2.*

For operating purposes, the system operating group uses the graph to determine the quantities of component gases required for a particular sendout in the following manner:

1. Determine the sendout required from the West Conshohocken plant.
2. Locate the required West Conshohocken sendout on the scale at the botom of the chart.
3. Project this point upward until it intersects the line of the first component gas.
4. Project from this intersection, horizontally to the vertical scale on the left, and record the type of component gas and its volume, as read from the vertical scale.
5. Extend the projection from the required West Conshohocken sendout, as in Step 3, until the line of the second component gas is intersected.
6. As in Step 4, record the name and volume of this component gas.
7. Repeat the procedure for all the lines on the chart (except for the natural gas-air shown on the dotted line) until all of the component gas lines have been intersected and their types and volumes recorded.
8. Total the component gases recorded in Step 7. This total should be 50 or 60 Mcf greater than the required West Conshohocken sendout found in Step 1, as allowance was made for reduction of oxygen in the purification process.

The list of gases with their volumes, found after completion of Step 8, makes up the required sendout. The chart shows natural gas-air as a dotted line and was not included when adding the component gases for the required sendout. The natural gas-air curve was plotted on the chart because the jet compressor meters are on the outlet and record the combination of natural gas and air delivered by the compressors, while the natural gas meters show the total natural gas added to the mixture. The portion of the natural gas used on the jet compressors can be determined by subtracting the jet air from the natural gas-air shown on the dotted line.

Rate Requirements

The gas system operator notifies the plant of the rates of various component gases required to meet the sendout conditions. When these rates are established the operator in the plant is responsible for maintaining the proper Btu. He is supplied with a graph of the 95% heat input curve, showing the Btu required for the specific gravity of the mixed gas going into the holder. If the gravity is at or below 0.50 he sets the calorimixer to enrich with natural gas to 520 Btu. When the specific gravity increases above 0.50, the operator uses the 95% heat input curve in the following manner:

1. Read the actual specific gravity of the gas from the recorder.
2. Refer to the plot of the 95% heat input curve.
   (a) On the left hand scale, locate the observed specific gravity.
   (b) Project this point to the right until it intersects the 95% heat input line.
   (c) Project from this intersection to the base scale, and read the number of Btu's the gas mixture should contain.
3. Make the necessary corrections by changing the Btu of the mixture in either of the two following ways:
   (a) Change the Btu of the natural gas-air mixture being produced by the jet compressors. This change is made by changing the setting of the air inlet valves to the jet compressors.
   (b) Adjust the calorimixer being used to control natural gas for enriching to the desired Btu.
4. Observe the effect of the adjustment as it is recorded by the calorimeter and recording gravity instrument.
5. Repeat the procedure, if necessary, until the observed specific gravity and Btu readings coincide with a point on the 95% heat input line.

A similar method of operation will be used for controlling the mixing of gases for the high gravity area.

Upon the introduction of natural gas into the Chester area, a number of appliance and house piping leaks were reported as a result of the new odorant in the natural gas. Some lifting flames were also reported. In order to eliminate the lifting trouble, an interchangeability laboratory similar to the one at West Conshohocken was set up at Chester, the appliances being adjusted for a base mixture of coke oven gas and reformed refinery oil gas at 520 Btu and 0.69 sp gr. Tests indicated that a reduction in the specific gravity with the resultant reduction in the percentage of inert constituents in the gas would increase its burning speed and eliminate the lifting flames. These findings were put into practice, eliminating the complaints.

The specific gravity of the gas is varied from 0.69 on days of high sendout to 0.65 on days of low sendout in order to reduce the variation in the percentage of inerts in the gas caused by mixing a uniform quantity of low specific gravity coke oven gas, a uniform quantity of enriched inert gas or air, and a variable quantity of enriched reformed gas. This results in a 3% *(Fig. 3)* variation in heat input to appliances, which is not objectionable. Whenever major changes are made in the plant operation, the resultant gas is tested on the appliances in the interchangeability laboratory to insure satisfactory customer operation. The limiting mixtures of several kinds of gases (which it might be necessary to produce) have been established and are ready for use as a guide for emergency operation.

(To be concluded next month)

Corrosion in th

ITS CAUSES AN

By E. O. RHODES

WHILE THIS ARTICLE treats the subject of corrosion in by-product coke plants, nevertheless its findings may well be applied to the broad field of gas manufacturing in general. It was presented before the operating division of the New England Gas Assn. in Providence, R. I., Oct. 5.

E. O. Rhodes gained wide recognizance in 1945 and 1946, when he conducted a survey of the German coal tar industry for the U. S. government. He received his bachelor and masters degrees at the University of Kansas, and later was awarded an industrial research fellowship in the University of Pittsburgh's department of industrial research (now known as Mellon Institute of Industrial Research). He has been associated with Koppers Co. Inc. for 25 years.

WITHIN recent years many new materials have been made available for the construction and maintenance of gas plants, with the result that maintenance costs due to corrosion have been materially reduced. In this paper causes of corrosion and some of the methods now used for minimizing or preventing corrosion will be reviewed after which the use of coal tar products for maintenance purposes in gas plants will be discussed. For purposes of illustration reference will be made to a modern by-product coke plant. For the sake of clarity the various sections of the plant will be discussed separately, giving for each section a brief description of the operations involved and pertinent facts concerning corrosion problems.

Coal arriving at the coke plant in railroad cars is emptied by a car dumper into a hopper from which it is discharged by gravity through a feeder onto a belt conveyor. The latter transports it to the hammermill building or to storage and reclaiming facilities. (See *Fig. 1.*)

Moist Coal Dust

The principal source of corrosion is moist coal dust. Coming from the dumping, feeding, transporting and grinding operations, coal dust settles on all exposed surfaces within the buildings that house the equipment. Moisture contained in the coal as received or condensed from the atmosphere combines with sulfur compounds in the coal to form weak acids which are corrosive to steel and iron. Corrosion is most severe on inaccessible, horizontal surfaces and in corners where the moist coal dust is most likely to accumulate.

If it were possible to exclude moisture from the coal dust at this point corrosion would be avoided. Also the use of corrosion-resistant metals would serve the same purpose. However, the former is impractical and the latter too expensive. The most practical solution, therefore, is to protect all metal surfaces with which the moist coal dust comes in contact with coatings that are as completely moisture- and acid-resistant as possible. In some cases it is possible to substitute non-metallic, structural materials which are not affected by the corrosive conditions in this area. Preserved wood and Transite have been used in this connection to a limited extent.

Exterior Susceptibility

To a certain but lesser extent the exterior surfaces of the buildings which house the unloading and crushing operations are subject to the same kind of corrosion as their contents. In addition, they are exposed to atmospheric corrosion the severity of which depends on geographical locations and proximities to other operations which produce corrosive materials within or outside of the coke plant.

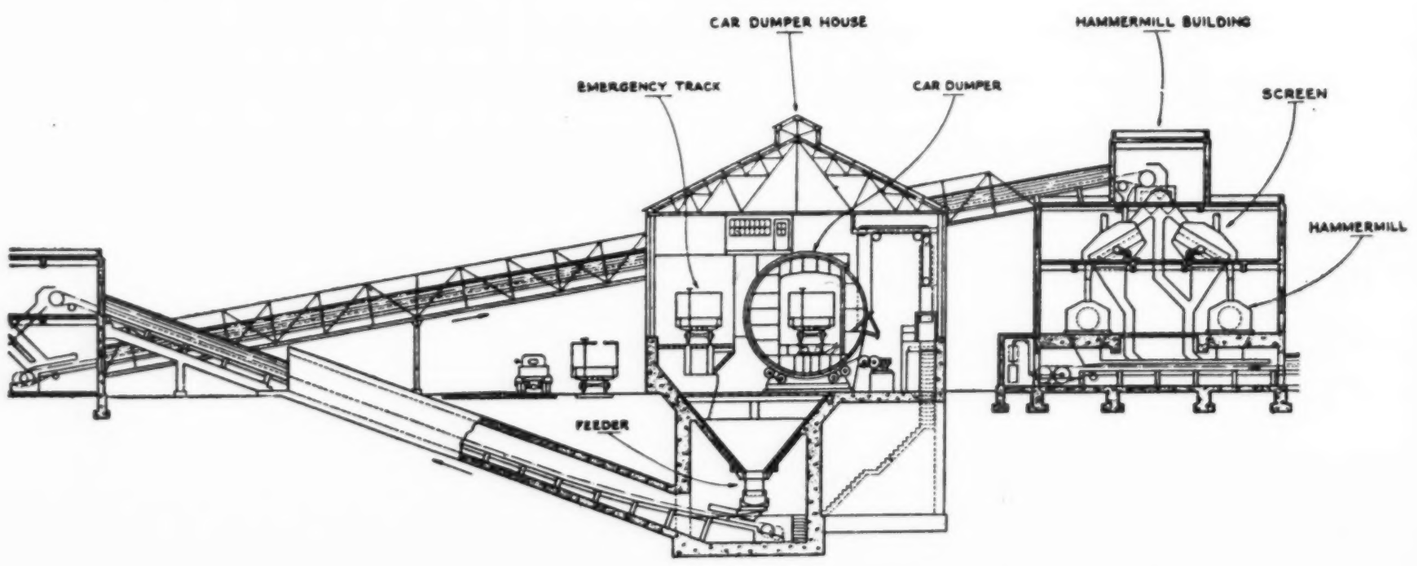
In *Fig. 2* is shown an arrangement for storing and reclaiming coal that is especially suitable in cases where the coal must be turned over at frequent intervals to avoid excessive degradation or loss caused by spontaneous combustion. By means of reclaiming feeders coal may be discharged by gravity from the storage pile onto a belt conveyor which transports it to a junction house. There, by means of adjustable chutes, it may be directed onto a belt conveyor which returns it to the top of the storage pile or it may be discharged onto a conveyor, shown in *Fig. 1*, which feeds the hammermills.

Corrosion in this area is similar to that described above. Coal dust, rain, corrosive materials from other sources, such as the quenching station or neighboring industries and, in some cases, salt air combine to produce corrosive conditions which call for the use of heavy, acid resisting, protective coatings for all exposed metal surfaces. Such protection is needed especially on all metal in contact with or buried in the ground in this area because it becomes very acidic. Where adequate coatings have not been provided to protect underground piping or steel work, cathodic protection can be employed to good advantage.

Conveyed to Mixer

After leaving the hammermill building, coal from storage or from the unloading station is transported by belt conveyor to storage bins in the mixer building (See *Fig. 3*). By adjusting the

Fig. 1. Coal unloading and crushing.



th Gas Plant

AN REVENTION

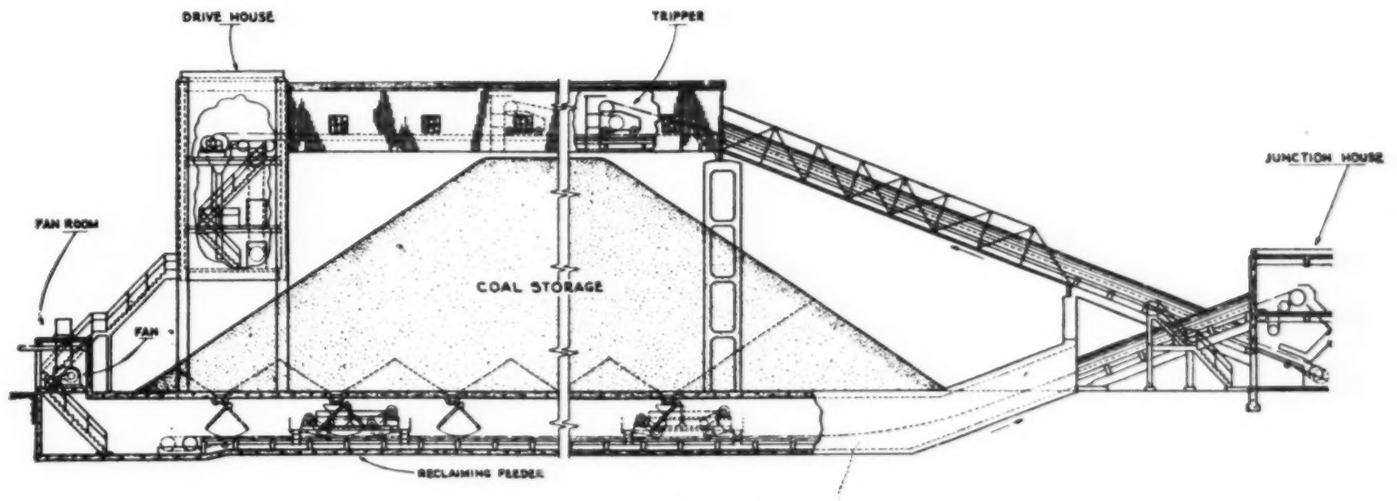


Fig. 2. Coal storage.

feeders on the bottoms of these bins different types of coal may be discharged simultaneously onto a master belt in the proportions needed for the type of coke to be produced.

Causes of corrosion and methods for its prevention are substantially the same as those described above and, therefore, do not require further discussion.

The master belt, mentioned above, conveys the blended coal to a bin located at the end and above the oven battery. (See *Fig. 4.*) From the coal bin the coal is discharged by gravity into a larry or coal charging car. The proper amount of coal for an oven charge is determined by volumetric measurement in the larry car or by weighing the car before and after filling it with coal. When the larry car has moved into position above the oven to be charged, the hopper gates are dropped in proper order and the coal falls into the oven through charging holes. The coal in the oven is leveled with a leveling bar operated from the pusher machine in order to provide a free passage for the gas along the top of the oven to the ascension pipe or pipes.

Quenching

After a suitable carbonizing period which varies with the demand for coke and with the type of coke desired, a pusher machine pushes the coke from the oven, through a coke guide and into a quenching car. The latter conveys the hot coke to a quenching station where it is sprayed with sufficient water or ammonia liquor to cool the coke below its ignition point. The quenched coke is then dropped from the quenching car onto an inclined wharf from which it is conveyed directly to cars, to blast furnaces or to a screening station.

The volatile products resulting from the carbonization of the coal in the ovens rise through ascension pipes into collecting mains where they are sprayed with recirculated ammonia flushing liquor. Cooling is effected by evaporation of a part of the flushing liquor. This serves to condense heavy tars and to wash entrained solids out of the gas. Ammonium chloride is absorbed from the gas and the sweeping action of the flushing liquor prevents the deposition and accumulation of pitch and solids on the bottoms of the collecting mains. Uncondensed gas and vapors pass from the collecting mains through a suction main to a downcomer and then to primary coolers. The suction main also conveys the flushing liquor and condensates from the collecting mains to the downcomer from which point the liquor and condensates flow by gravity to flushing liquor decanting tanks.

Different Degrees

In each of the six operations mentioned above, different degrees and types of corrosion are encountered.

Steel surfaces in the master belt conveyor and the oven coal bin structures are subjected to substantially the same conditions that have been described for the remainder of the coal handling equipment. Concrete coal bins sometimes develop hair cracks. Spalling or sanding of the concrete surfaces also may occur especially when such surfaces are exposed to salt air or to the mist from quenching stations. Such effects are especially pronounced in the winter months when alternate freezing and thawing occurs.

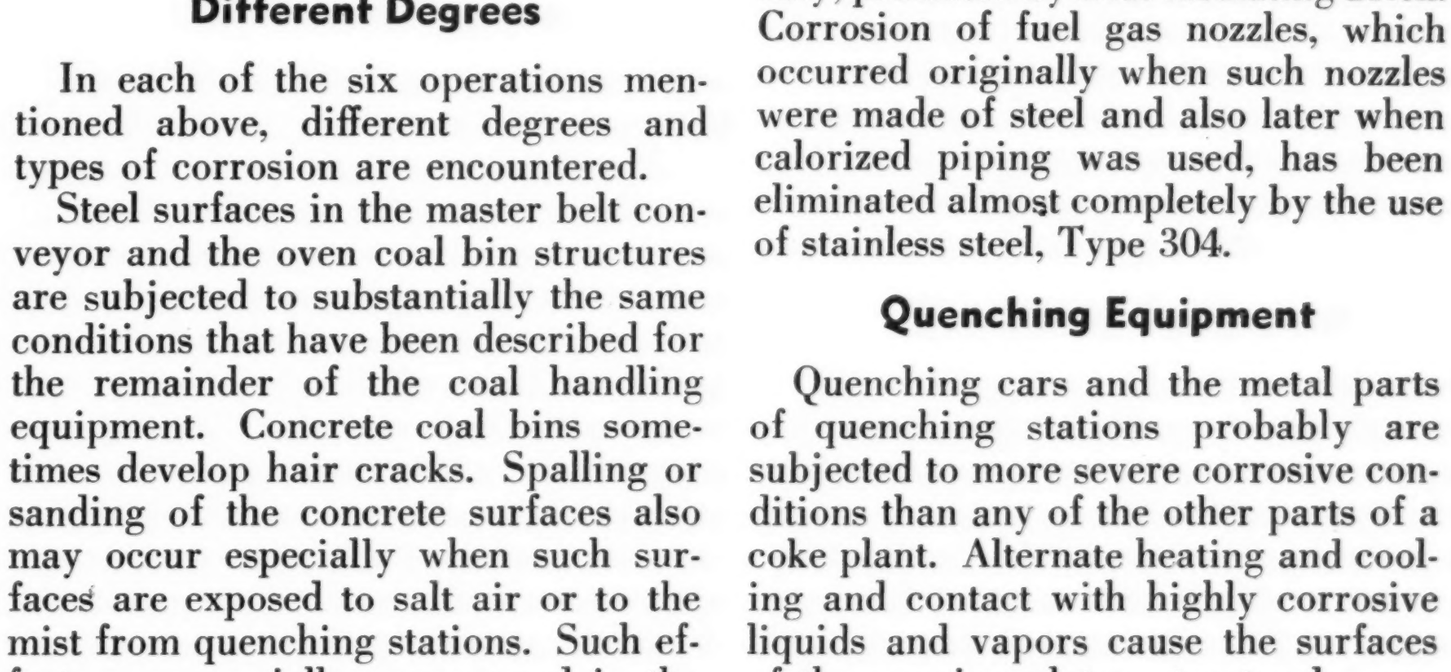
Larry cars, and particularly their coal hoppers, are in contact with smoke, dust and flames during each oven charging operation. Protective coatings are damaged by such contact and need to be renewed frequently.

The ovens proper suffer less corrosion than might be expected because practically all of the members of which they are constructed are warm enough at all times, except during heavy rains, to prevent the accumulation of moisture. Paints and coatings applied to buckstays and other metal parts that are dry but not subjected to extremely high temperatures are used mainly to improve the appearance of the oven structure. Metal parts such as doors and jamb sections, waste heat damper bearings and others which are subjected to high temperature conditions are constructed of cast iron and, where necessary, protected by heat-insulating brick. Corrosion of fuel gas nozzles, which occurred originally when such nozzles were made of steel and also later when calorized piping was used, has been eliminated almost completely by the use of stainless steel, Type 304.

Quenching Equipment

Quenching cars and the metal parts of quenching stations probably are subjected to more severe corrosive conditions than any of the other parts of a coke plant. Alternate heating and cooling and contact with highly corrosive liquids and vapors cause the surfaces of the wearing plates, structural members and running gear to corrode rapidly. Continuous maintenance and rebuilding every 12 to 18 months is required in most cases. The use of stainless steel for the construction of quench-

Fig. 3. Coal blending.



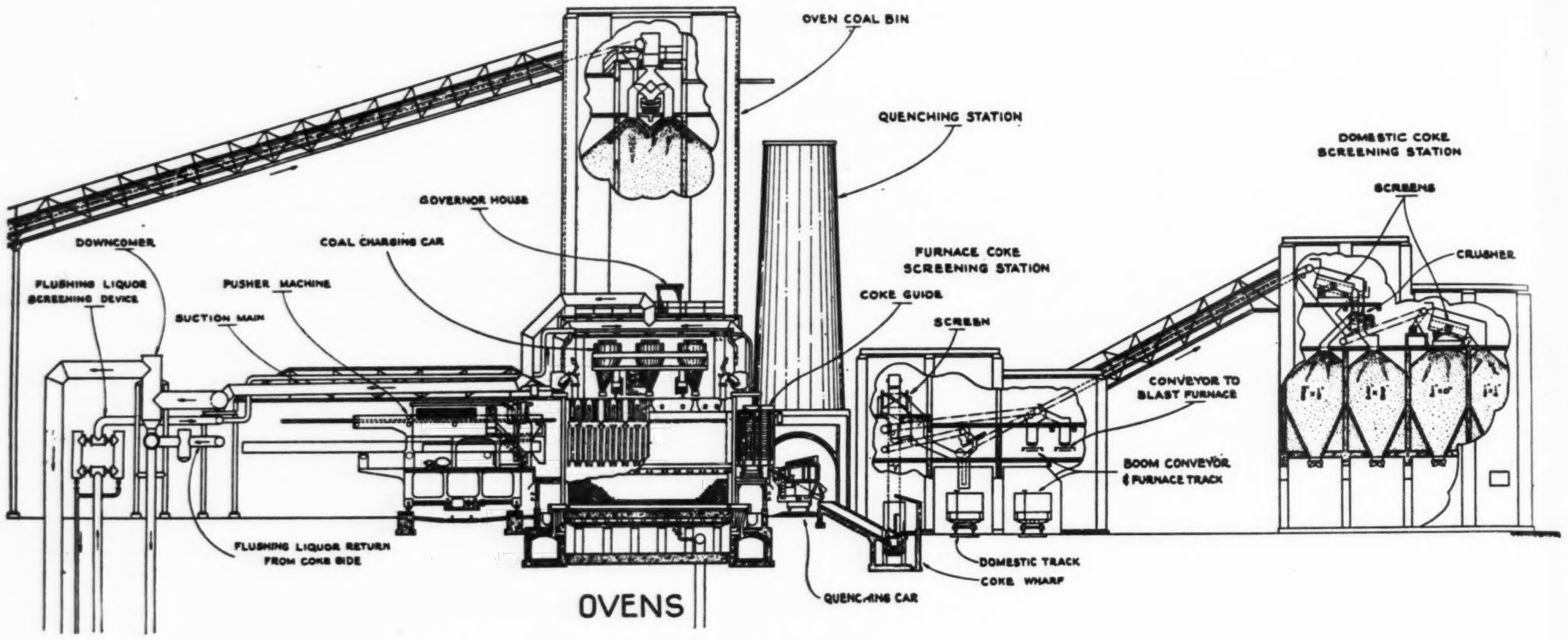


Fig. 4. Coke handling.

ing cars has been considered. The initial expense would be large but might be more than offset by lower maintenance costs.

Recent tests have indicated that maintenance costs for quenching cars may be materially reduced by means of certain heavy duty coal tar coatings. Inside the quenching station the greatest amount of corrosion occurs in pumps, piping and spray nozzles used for recirculating and spraying the cooling liquid onto the coke. The quantity of liquid required to cool the coke is so great that the unvaporized portion must be collected and re-used. This results in the concentration of sulfates, carbonates, cyanates, chlorides and other corrosive substances in the coolant. Corrosion is even more severe when the coolant consists principally or entirely of ammonia waste liquor. Although many different alloys have been tried in this location, expendable steel nozzles, pipes and pumps are considered at present to be most economical.

Creosoted Ties

Corrosion in another part of the quenching station has been eliminated by substituting creosoted ties for the cast iron chairs that formerly supported the tracks. The cast iron chairs not only corroded badly but replacement was difficult because the nuts and bolts which held the chairs to the concrete base also corroded and could not be loosened easily.

Coke handling equipment, in general, is affected by corrosive conditions. Steam rising from the hot quenched coke as it passes from the wharf to screens, crushers, bins and trucks increases the humidity in this portion of the plant. Also, corrosive substances contained in the water with which the coke is quenched cause some deterioration of surfaces with which the coke comes in contact. Corrosion is particularly severe on metal parts which come in contact with calcium chloride when it is used as a dedusting agent for domestic coke. 18-8 (Type 304) stainless steel has been found to resist such corrosion satisfactorily. Aluminum may also be used to advantage but is subject to pitting wherever coke breeze can accumulate.

The ascension pipes, collecting mains, suction main and downcomer which conduct the gas, condensates and flushing liquor away from the ovens are corroded to only a small extent. In the case of the ascension pipes an alloy cast iron containing 0.15-0.30% chromium and 0.40-0.60% molybdenum is used. It has superior heat resisting properties both as to high temperature strength and resistance to thermal fatigue. Ascension pipe goose neck and return bend castings preferably are made of cast iron conforming to ASTM Standard Specification A-126, Class B. The collecting mains, suction main, and downcomer are corroded slightly on the inside, particularly at liquor-gas interfaces, but they are constructed of heavy plate and do not require patching or replacement for many years. The outsides of the collecting mains may sometimes be damaged by overheating or by leakage of flushing liquor at valve stems. However, except in such special cases, they suffer little corrosion because they remain dry substantially all of the time. The suction main and downcomer also remain dry and are not seriously affected by corrosion.

Ammonia Sprays

Uncondensed gas and vapors leaving the downcomer pass through a steel cross-over main to primary coolers where further reduction of temperature to about 200°F is effected directly by ammonia liquor sprays or indirectly by water cooled tubes. In the former case the primary coolers are filled with

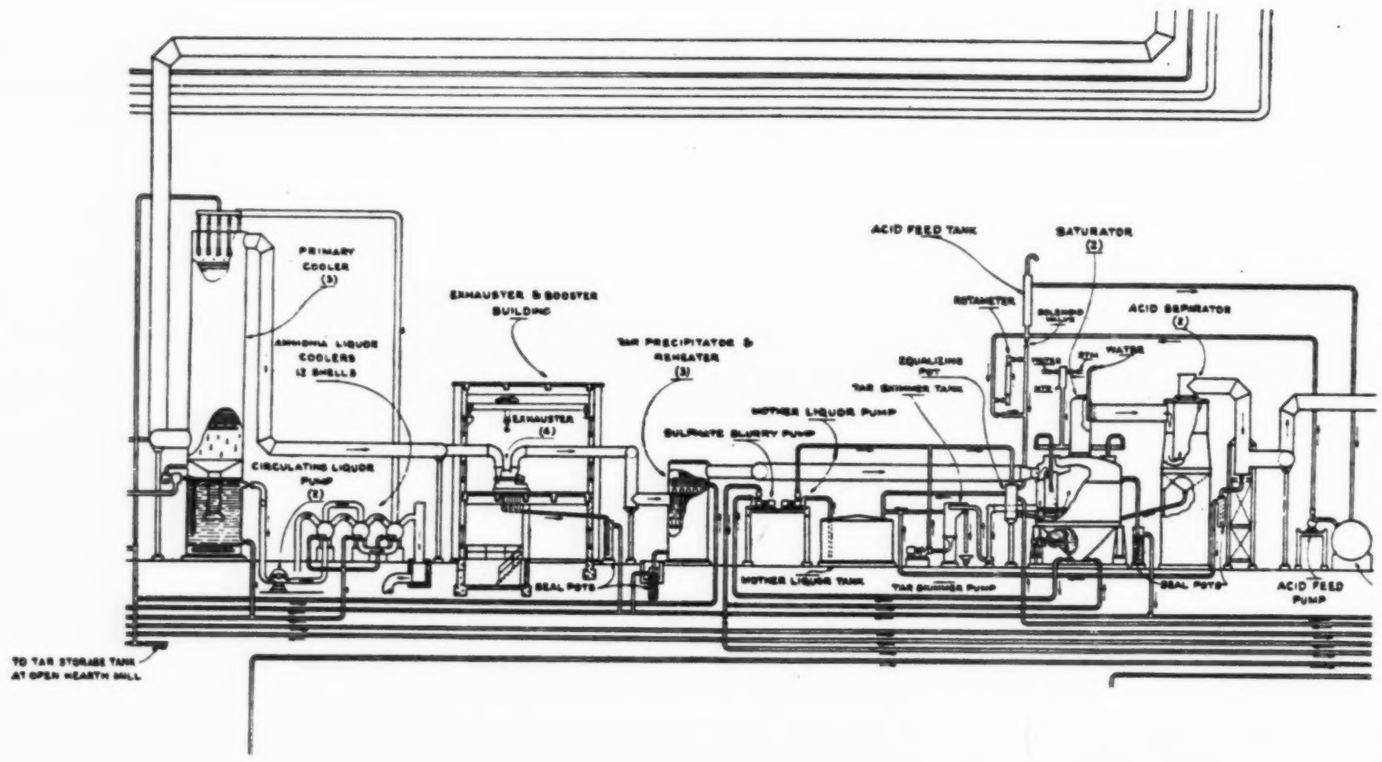


Fig. 5. Gas handling—tar extraction and sulphate recovery.

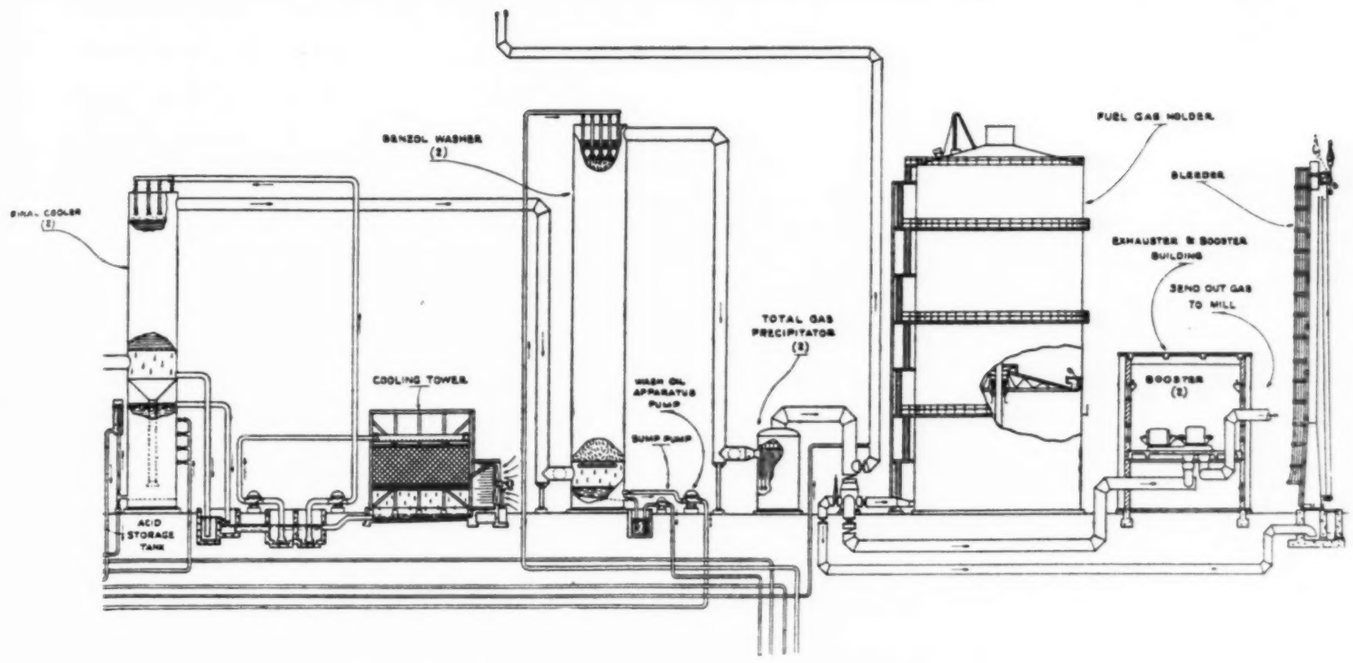


Fig. 6. Benzol recovery and gas sendout.

wooden hurdles or ceramic tower packings which are not affected appreciably by the gas or ammonia liquor. The ammonia liquor leaving the primary coolers contains light tar which is removed continuously by decantation. After cooling, the liquor is returned to the primary coolers.

In some cases cast iron radiator sections are used for cooling the recycled liquor. They are cooled on the outside by water which may be salt or brackish if the plant is located near the sea coast. In such cases corrosion is severe and various methods for minimizing it are used. Valve cases may be constructed of bronze alloys or coolers of the shell and tube type may be used with water inside the tubes and ammonia liquor on the outside.

One plant using river water with an appreciable acid content employs bimetallic tubes made of copper on the inside and steel on the outside. In primary coolers of the indirect type the steel cooling tubes last for 7 to 10 years. Such corrosion as does take place is confined largely to the water side near the top where the water is aerated. Even in this location corrosion is not sufficient to warrant the use of expensive alloys.

Exhauster Construction

From the primary coolers the gas passes through exhausters, tar extractors and reheaters to ammonia saturators. (See *Fig. 5.*) The exhausters are made of alloy steels. They are affected very little if at all by the gases which they handle while they are in operation. However, standby units may be corroded slightly if air is permitted to enter them. Loss of metal is not serious but sufficient unbalance may develop to cause vibration followed by bearing troubles. Admission of coke oven gas into the exhausters while they are standing still to exclude air is an effective way to avoid corrosion at this point.

Little or no corrosion should take place inside tar extractors and reheaters if the temperature of the gas is above the dew point of its moisture content and if its oxygen content is low.

The gas leaves the reheaters at about 140°F and enters the saturators, where it comes in contact with a sulfuric acid solution containing about 5 to 9% acid. Ammonia contained in the gas combines with the sulfuric acid to form ammonium sulfate which crystallizes out of the mother liquor. A slurry containing mother liquor and ammonium sulfate crystals is withdrawn continuously to centrifugal driers which remove the crystals. The mother liquor is returned to the saturators.

Since 1942 saturators have been built of Type 316 stainless steel. This has eliminated the corrosion problems that were encountered when lead lined saturators were used, and it has permitted the design and operation of the saturators to be improved as well. Type 316 stainless also is used in the construction of the acid separators in which acid solution entrained in the gas leaving the saturators is removed and returned to the saturators.

The exterior surfaces of the various types of equipment discussed above are exposed to corrosive conditions resulting from steam, mist from the quenching tower, and gaseous atmospheres containing hydrogen sulfide, cyanides and other corrosive substances. In the vicinity of the saturators and acid separators sulfuric acid is also a factor. Mastic floors may be used to advantage in this area.

Further Steps

Following the removal of ammonia in the sulfate saturators, the gas passes upward through the final cooler countercurrent to recirculated water that is cooled in a wooden cooling tower. The cooled gas then flows upwardly through the benzol washer where it is scrubbed with petroleum wash oil, which absorbs light oil from the gases. (See *Fig. 6.*) The latter then passes through an electrical precipitator to remove traces of entrained water and oil, after which it flows to the fuel gas holder or to the oven battery where it is used for heating the ovens. In plants that make gas for city use sulfur must be removed before the gas is ready for distribution. In some plants the sulfur is lost to the atmosphere in the form of hydrogen sulfide, in others it is recovered as elemental sulfur. But, in most cases, it combined with iron oxide forming iron sulfide which on exposure to air reverts to iron oxide which may be reused.

In each of these cases serious corrosion difficulties are encountered. Plastic coatings are being used in some cases to minimize or eliminate the corrosion but they are usually expensive and not entirely satisfactory. Coal tar coatings have been used to some extent and appear to be especially promising.

Little Internal Corrosion

The various pieces of equipment mentioned above, with the exception of sulfur removal devices, are subjected to little corrosion internally and external corrosion is only that which results from contact with air containing the various coke plant gases and vapors which have been mentioned previously.

The following pieces of equipment, illustrated in *Figs. 4, 5* and *6*, are the source of raw materials from which all

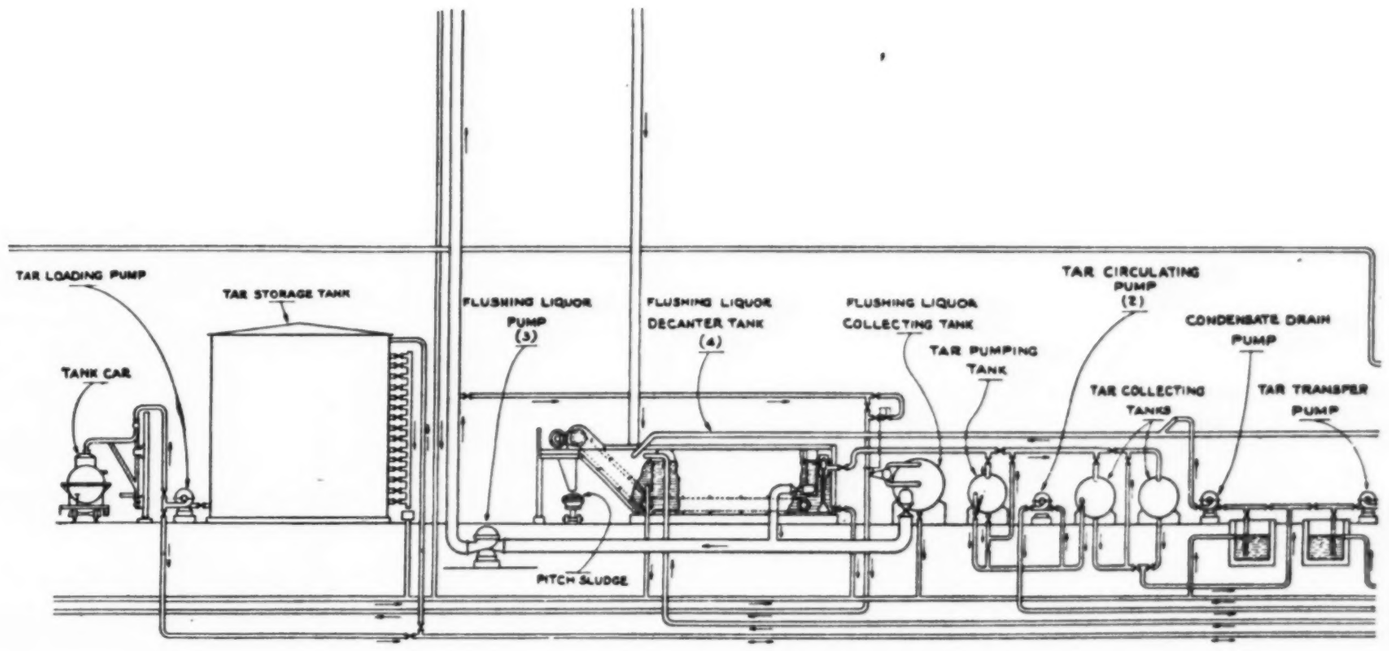


Fig. 7. Flushing liquor decanting system.

the so-called by-products of coke manufacture are recovered. A mixture of flushing liquor and tar comes from the downcomer *(Fig. 4)* and from primary coolers, exhausters and tar precipitators *(Fig. 5)*. Ammonium sulfate is recovered from the slurry produced in the saturators *(Fig. 5)* and light oil is distilled from wash oil by which it is absorbed from the gas in the benzol washer *(Fig. 5)*.

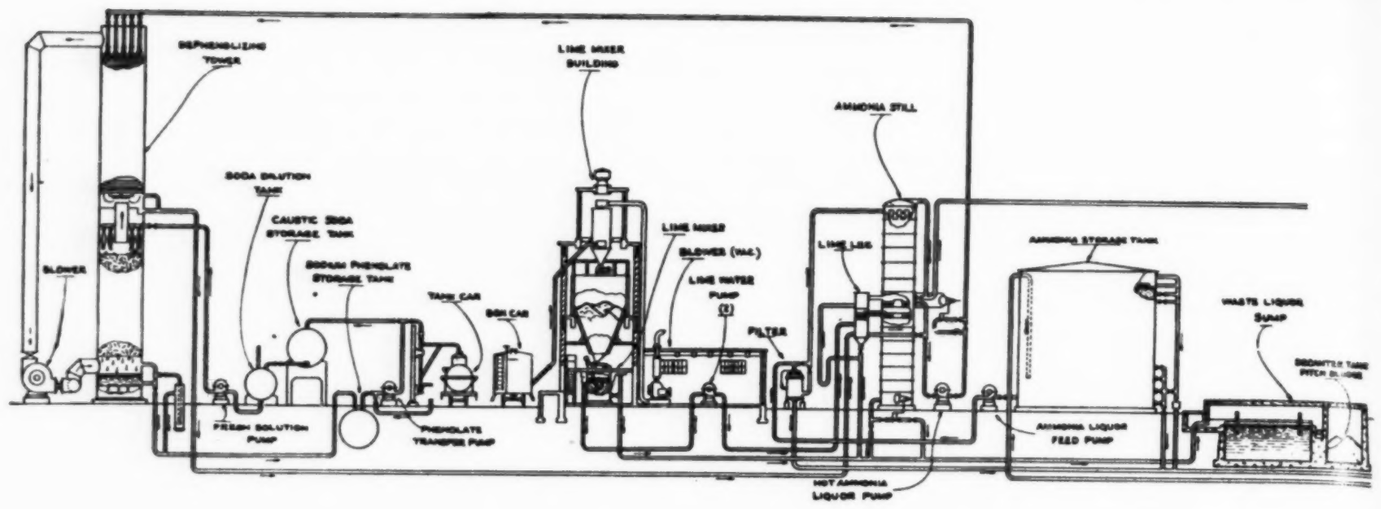


Fig. 8. Ammonia and dephenolizing plant.

Recovery of Tar

The recovery of tar from the flushing liquor is illustrated in *Fig. 7*. The mixtures of flushing liquor and tar flow from the downcomer, primary coolers, exhausters and precipitators to flushing liquor decanting tanks where tar settles to the bottom and liquor rises to the top. They flow to separate collecting tanks. The greater part of the liquor is pumped to the collecting mains for flushing purposes but a part of it is processed for the recovery of ammonia and phenols.

The tar is pumped to storage, from which it is moved to tar plants for distillation or to open hearths for fuel. In modern plants pitch sludge, which settles to the bottoms of the flushing liquor decanting tanks, is removed continuously by a scraping conveyor.

Considerable corrosion occurs on the interior and exterior surfaces of the flushing liquor decanting tanks where they are exposed frequently or continuously to steam or water and air. Heavy protective coatings are indicated.

The Ammonia Still

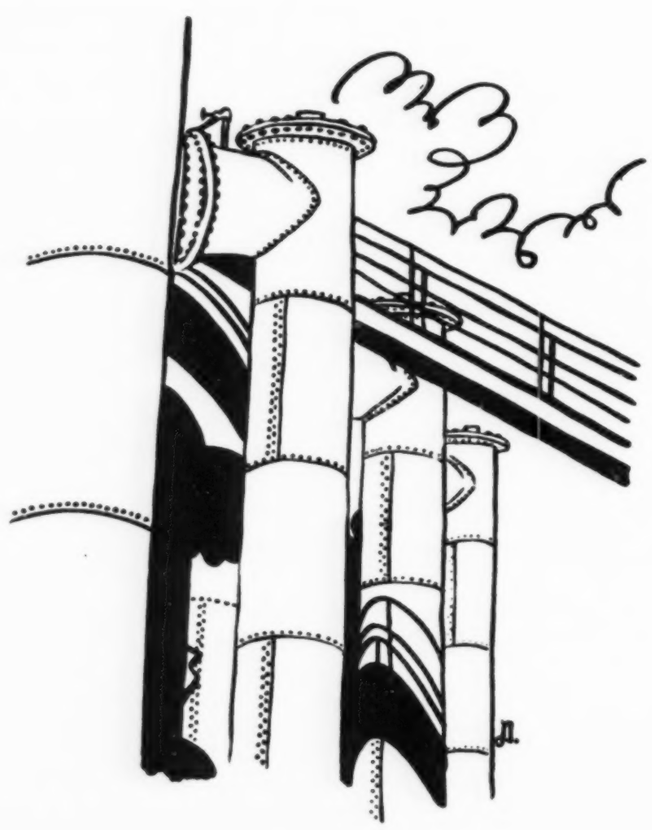
A part of the ammonia liquor, separated from tar in the flushing liquor decanter tank as described above, is pumped from its storage tank to the ammonia still. *(Fig. 8.)* The latter consists of a cast iron bell and tray column divided into two sections. In the upper section, usually called the "free leg" or "free still," ammonia is vaporized from the liquor by means of steam. Ammonium compounds which readily dissociate give up their ammonia in this section of the still. The mixture of ammonia and other gases from the top of the free still is introduced into the gas stream from the ovens at a point ahead of the primary coolers. The ammonia from the still, together with the free ammonia contained in the gas, is then recovered as ammonium sulfate in the sulfate saturators.

From the bottom of the free leg of the ammonia still, the ammonia liquor is pumped to the dephenolizing tower where phenols are removed by the continuous recirculation of steam, first through the hot ammonia liquor to vaporize the phenol and then through a caustic soda solution to absorb the phenol from the steam. Phenols leave the system as sodium phenolate. The dephenolized ammonia liquor is returned to the lower or "fixed leg" of the ammonia still where milk of lime is added to permit the dissociation of "fixed" ammonium compounds by means of steam. The liberated ammonia combines with that from the free leg of the still and is introduced into the gas stream ahead of the sulfate saturators. Dephenolized still waste from the bottom of the "fixed still" is discarded or is used for quenching coke when disposal otherwise is undesirable or impossible.

Cast Iron Construction

The ammonia still is constructed entirely of cast iron. Some corrosion occurs and replacements of castings occasionally are required. Where dephlegmators are used to condense steam from the ammonia leaving the still they preferably should be made of cast iron to minimize corrosion.

No corrosion problems are encountered in handling the lime used in connection with the ammonia still. Also little corrosion takes place in the dephenolizing tower, except for caustic embrittlement which may occur if mild steel is used and is not properly stress-relieved. Monel metal has been used successfully in the reboiler section of the dephenolizer to eliminate this source of trouble.



The exterior of the dephenolizing tower is exposed to the general atmospheric conditions prevailing in the coke plant which vary somewhat depending upon proximity to the quenching station, salt air, etc. In addition, some corrosion results from spillage of water, and caustic solutions and from contact with steam, ammonia and pyridine vapors. Therefore, to protect exterior surfaces against these corrosive conditions the use of heavy duty protective coatings is desirable.

The recovery of ammonium sulfate *(See Fig. 9)* in the form of a slurry in the sulfate saturators has been discussed in connection with gas handling and tar extraction *(Fig. 5)*. The slurry is centrifuged batchwise or continuously to recover the ammonium sulfate crystals from the mother liquor. The latter is returned to the saturators and the crystals, after water washing and drying in the centrifugals or "driers," are ready for shipment.

Remove Sulfuric Acid

The pumps, valves, centrifuge baskets and other parts of the equipment which come in contact with the slurry or wet crystals are constructed of Type 316 (17% Cr, 12 Ni, 2½ Mo) stainless steel to eliminate corrosion. If care is taken to remove sulfuric acid completely from the sulfate crystals by adequate washing in the driers and if spillage is avoided, little corrosion in and around the sulfate equipment is experienced. Brick and concrete in the sulfate storage buildings are sometimes coated with coal tar paints to protect them against traces of sulfuric acid remaining in the ammonium sulfate.

In connection with benzol recovery and gas sendout *(Fig. 6)* previously discussed, the removal of light oil from the gas by means of petroleum absorbing oil or wash oil was mentioned. The benzolized wash oil enters a wash oil still where crude light oil is recovered. It is then rectified to separate it into intermediate light oil and secondary light oil. (See *Fig. 10.*)

The secondary light oil enters a rectifying column to remove forerunnings, consisting large of CS_2, which is returned to the gas. The remainder of the secondary light oil may then be fractionated in a continuous column to produce motor benzol and motor fuel bottoms.

The crude bottoms leaving the CS_2 rectifying column or the motor fuel column may be washed with concentrated sulfuric acid and fractionated in continuous rectifying columns or a batch still to produce pure benzol, toluol and xylol.

Intermediate light oil from the bottom of the light oil rectifying column is transferred to the crude still for batch distillation to recover solvent naphtha.

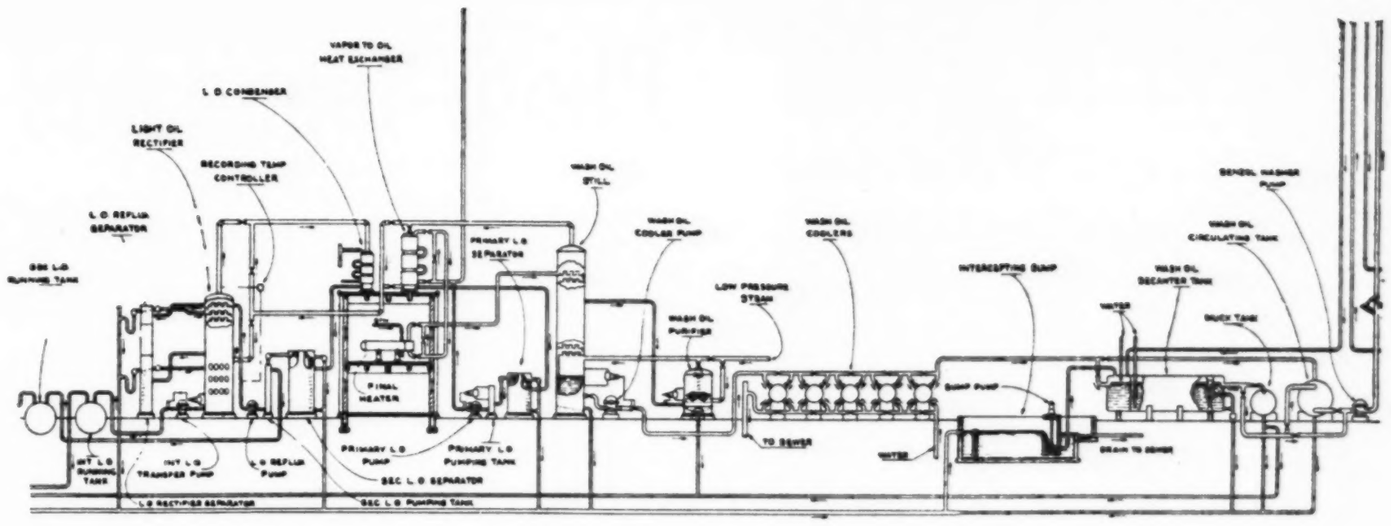


Fig. 10. Light oil plant.

Washing Corrodes

Few corrosion troubles are encountered in the various light oil recovery and refining steps discussed above *(See Fig. 10, above)*. Neither the wash oil nor any of the light oils are corrosive themselves. However, the use of sulfuric acid and caustic soda for washing the oils before distilling them to make pure products does cause some corrosion of the washers and auxiliary equipment unless special precautions are taken. Especially important is the use of monel for agitators and valves. Exterior surfaces are protected with acid resisting enamels. With the above exception most of the light oil equipment and buildings can be protected adequately with decorative enamels in colors or aluminum.

Summarizing the foregoing review of corrosion problems encountered at a typical by-product coke plant, it may be observed that they are of two general types which may be designated as internal and external. The former pertain to interior surfaces of processing equipment. The development of special metals, such as stainless steels and monel, has made it possible to eliminate corrosion troubles of this sort almost completely. The designers of gas plant equipment are constantly on the watch for new corrosion-resistant materials of construction and can be depended upon to employ them as soon as it is economically feasible to do so.

Most of the external corrosion in gas plants would be eliminated if it were economical to substitute special alloys for steel. In certain cases, such as quenching cars, it is possible that this can and should be done. However, in the majority of the cases it will continue to be more economical to employ steel and protective coatings, especially since new types of protective coatings have been and are being developed that are much more suitable for gas plant service than protective coatings previously employed.

Two Classifactions

Generally speaking, protective coatings may be divided into two broad classifications; namely, non-bituminous and bituminous. Non-bituminous protective coatings may in turn be classified as oil base coatings, oil modified resinous coatings and lacquer type coatings. Bituminous coatings may be further subdivided into asphaltic and coal tar types.

For many of the exterior surfaces in a gas plant non-bituminous coatings are entirely adequate. This is especially true of oil modified resinous coatings which because of the phenolic, alkyd, coumarone, terpene or other types of resin contained in them are more impervious to moisture and more desirable under atmospheric conditions of the kind that prevail in gas plants than oil-type or lacquer-type coatings. Oil modified resinous coatings are especially suitable in locations where light reflection and appearance are important and corrosive conditions are not severe.

As the preceding review has indicated, there are many parts of a gas plant that require the use of heavy duty, acid-resisting, protective materials. The use of bituminous coatings in such locations is increasing due largely to the development in recent years of new materials and methods of application. This is especially true of coal tar coatings. They should be of particular interest to owners and operators of gas plants who produce the basic material, coal tar, from which such coatings are made.

Coal Tar Enamels

Coal tar enamels of the hot application type have long been used for the protection of ships, penstocks, lock gates, pipelines, and other structures exposed to highly corrosive conditions. They are especially suitable for the protection of all buried pipelines or steel supports in gas plants where the soil becomes highly acidic.

The sanding, spalling and checking of concrete above or below ground can be prevented by the use of tar primers and seal coats.

For the protection of steel structures generally coal tar paints and coatings can now be furnished in a complete range of consistencies. Also equipment suitable for their application is available.

By using coal tar paints and coatings gas plants can help to establish industrial outlets for this important group of products made from one of the primary products of coal carbonization and at the same time they can obtain improved protection of their structures and equipment.

The writer wishes to express his appreciation of assistance received from C. F. Pogacar of the research department; from D. J. McFarlin, V. V. Greg, O. L. Henry, R. A. Blackburn and W. J. Mischler of the engineering and construction division; and from Dr. W. F. Fair Jr. and H. J. Cibula of the tar products division, Koppers Co. Inc. Much of the information used in the preparation of this article was furnished to the writer by them.

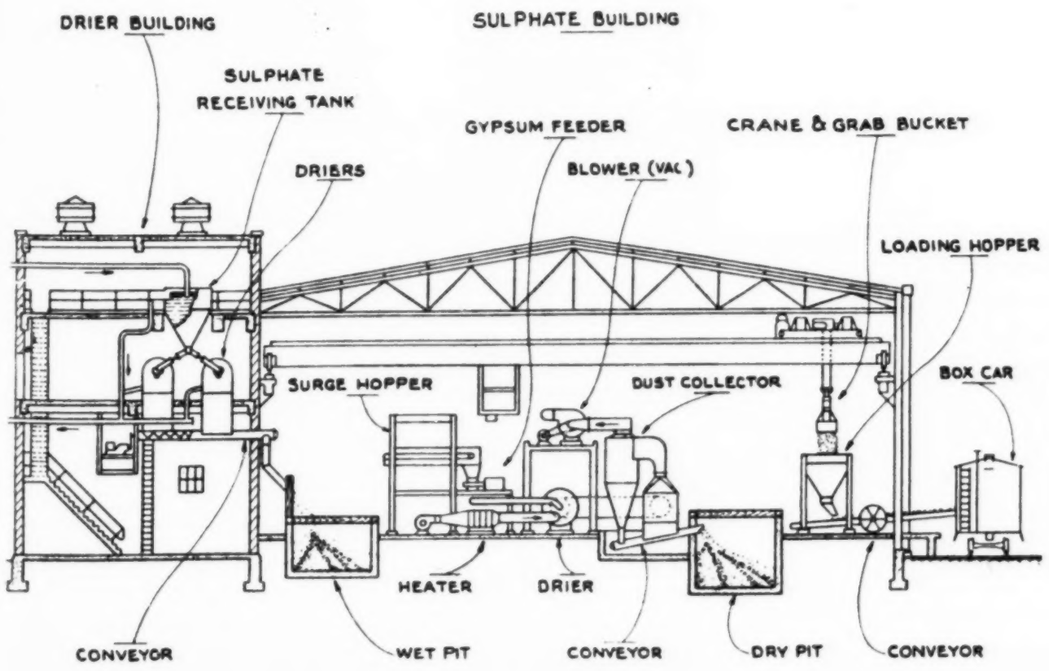


Fig. 9. Sulphate plant.

Photo-highlights of AGA Gathering

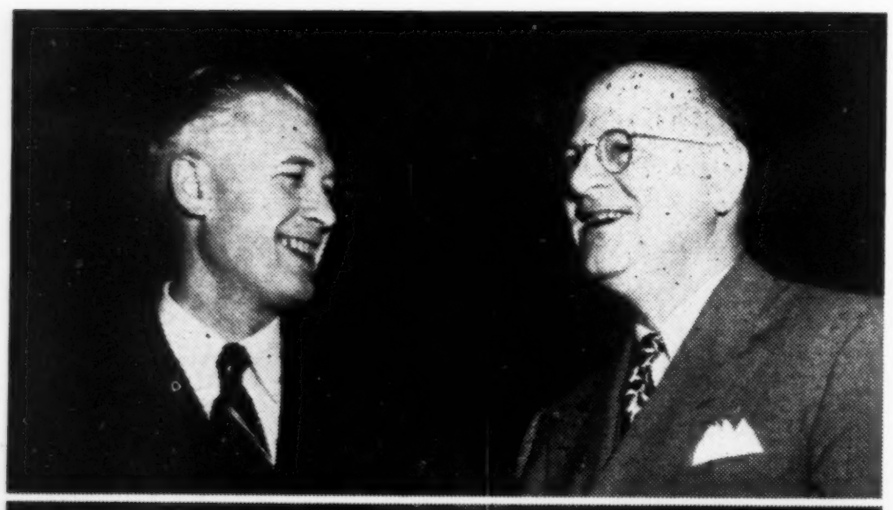
. . . a pictorial follow-up of last month's convention reports

KEYNOTE SPEAKER: Emil Schram, president, New York Stock exchange.

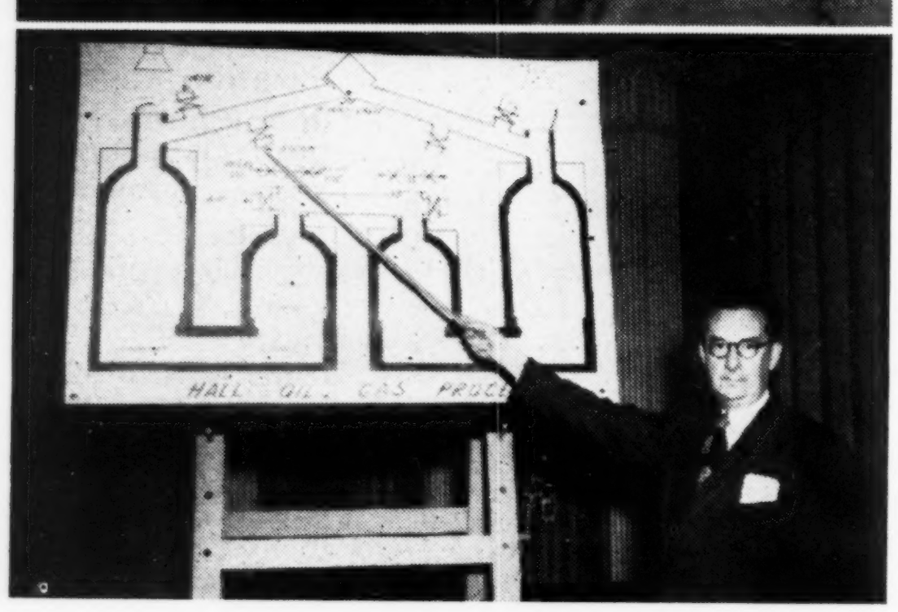
AWARD WINNERS, home service achievement: F. Jean Torrance, Peoples Natural Gas Co. (Johnston, Pa.); Eleanor Marvin, Manufacturers Light & Heat Co. (Steubenville, Ohio); Arvilla Patison, Lone Star Gas (Fort Worth). At far left, Camille David; at far right, Elizabeth Sweeney Herbert, both of McCall's magazine.

TALKING IT OVER: J. M. Pickford, Northern Indiana Public Service, distribution committee chairman; G. B. Johnson, Minneapolis Gas Co.; and W. C. Peters, Northern States Power Co. (St. Paul, Minn.).

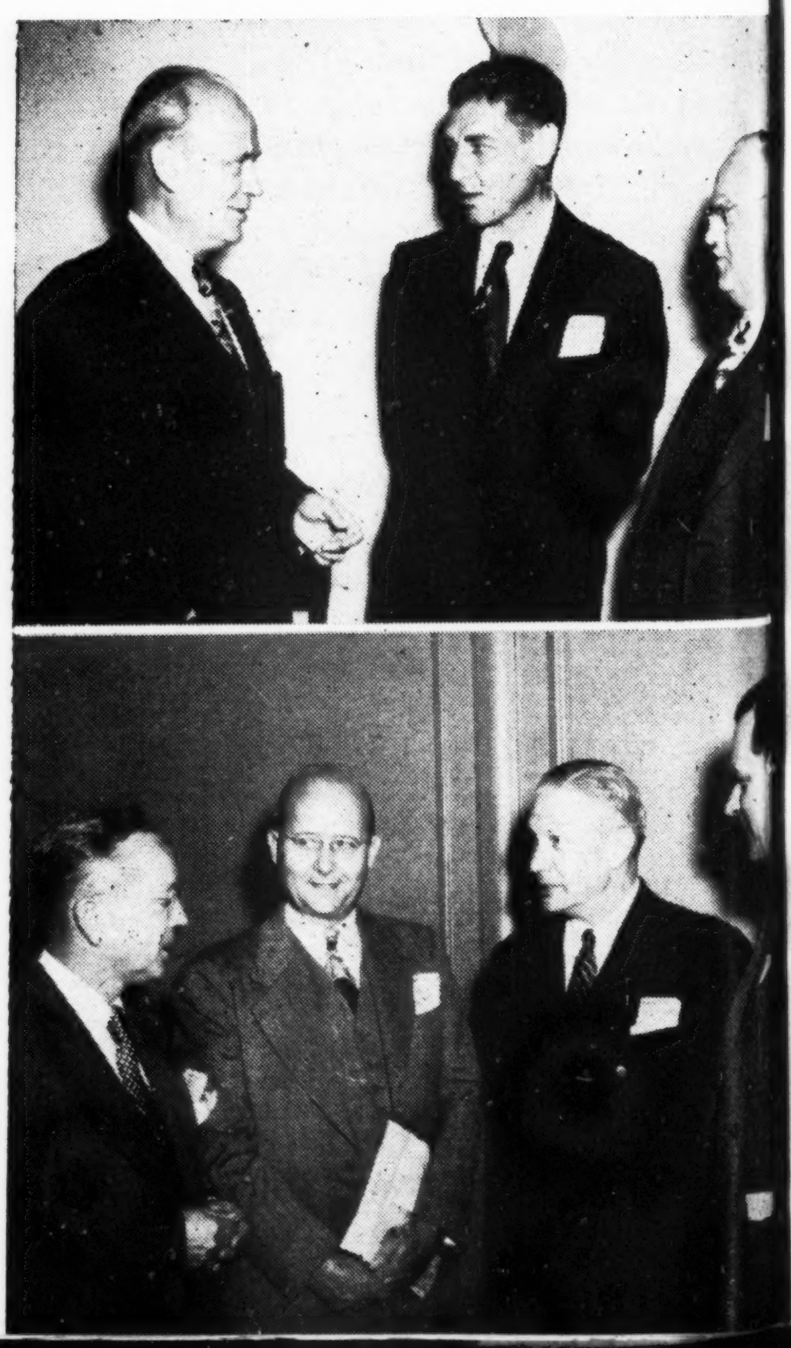
RETIRING AGA president, Robert W. Hendee, Colorado Interstate Gas Co., turns gavel over to his successor, Hugh H. Cuthrell, Brooklyn Union Gas Co.



AT LEFT, top, W. F. Brown, safety director, ConEd of New York (left), talks with Ned H. Dearborn, president, National Safety council. Below: Hall N. Henry, NEGEA Service Corp., discusses oil gas.



AT RIGHT, top, D. W. Reeves, Oklahoma Natural Gas Co. (left), talks to Leon Ourusoff, nominating committee chairman, and C. H. Lekberg, Northern Indiana Public Service Co. Below, technical men S. E. Trouard, New Orleans Public Service; R. C. Holcombe, Philadelphia Gas Works; G. R. King, Philadelphia Electric Co.; and H. T. Jayne, Philadelphia Gas Works.



A STUDY OF PIPE THREADS AND PIPE DOPES

By CHARLES E. LEE

Southern California Gas Co.

The large number of leaks in threaded joints on meter sets, appliance connections, and other places where threaded fittings are used, prompted a search for corrective measures. The search was divided into three parts: a study of the accuracy with which commercial pipe threads are made and the effects of inaccuracies on leakage, a study of the sealing ability of the various types of thread dopes, and a study of methods of make-up of the joint.

PIPE THREADS

ROBERT BRIGGS is credited with the development of the first American practice for external threads on pipe. The American Society of Mechanical Engineers and most manufacturers adopted the Briggs Standard as standard practice in 1886. Master plug and ring gages were made at this time. Since then the Briggs Standard has been revised and expanded many times.

The present specifications for taper and straight pipe threads have been approved by the American Standards Assn. The AGA and the ASME were joint sponsor organizations. The basic dimensions and tolerances are published in "American Standard Pipe Threads," as publication B 2.1 - 1945. The angle between the sides of the thread is 60° when measuured in an axial plane and the line bisecting this angle is perpendicular to the axis. The taper is 1 in 16. The number of threads per inch and the length of threaded portion vary with the pipe size. The thread is truncated.

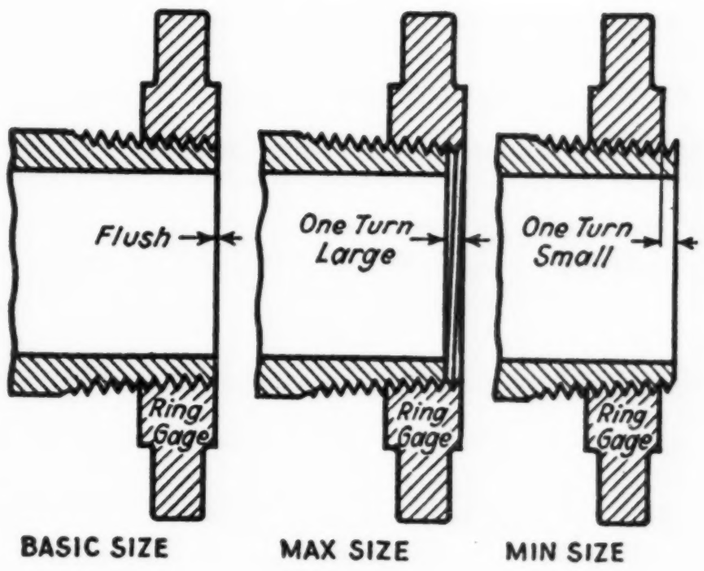


Fig. 2. Gaging external taper threads with the thin ring gage.

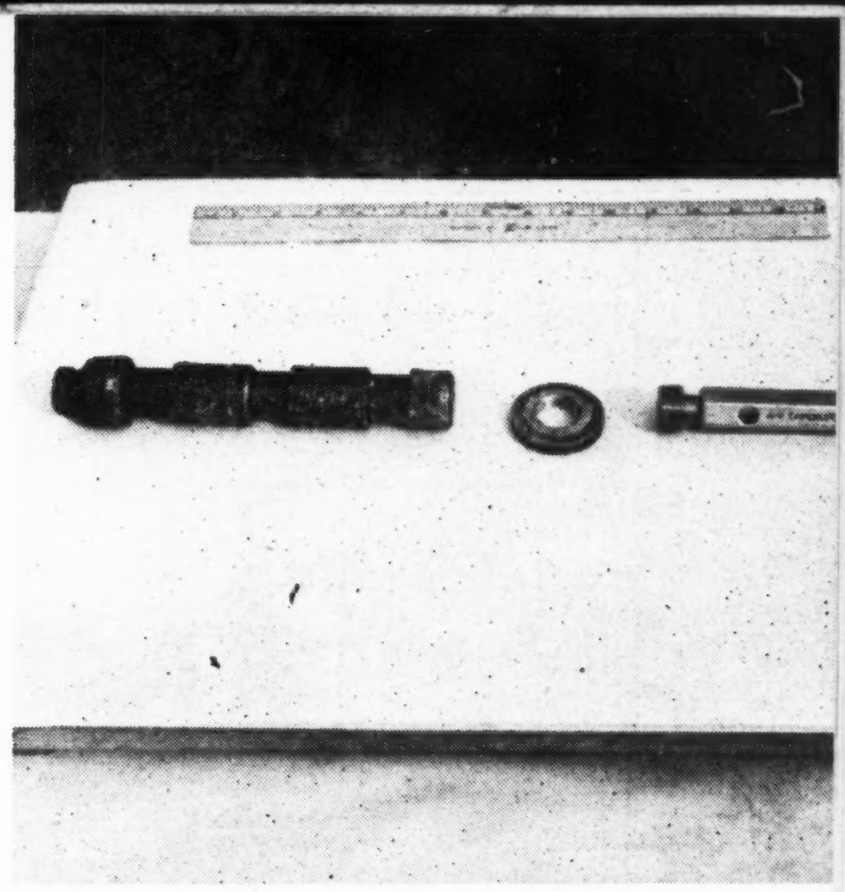


Fig. 1. Gages for ¾-in. pipe threads.

The basic dimensions for ¾-in. pipe threads, the size used in largest quantities, allow for a hand-tight engagement of 4.75 threads and the engagement of three additional threads by wrench. On nipples of all sizes the last 3.47 threads are imperfect due to the chamfer on the die and are not intended for make-up.

Plug and ring gage practices have been set up for control of the quality of threads and to insure interchangeability of product. The practices are intended to provide a check on the accumulated inaccuracies in taper, lead and angle. The gages for ¾-in. pipe are shown in *Fig. 1.*

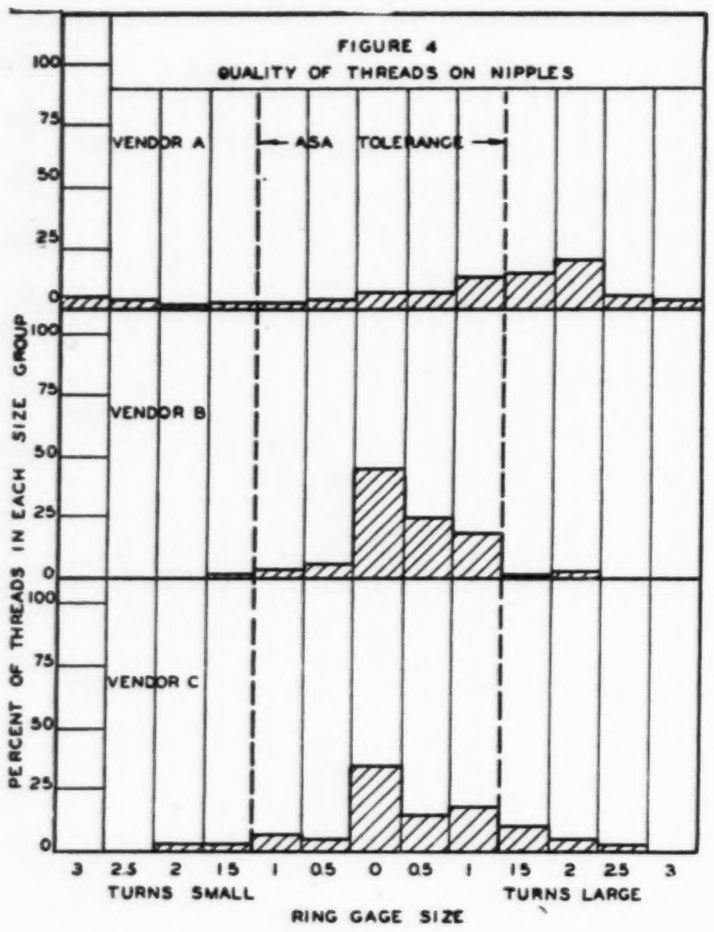
The method for gaging external taper threads with the thin ring gage is shown in *Fig. 2.* The gages are screwed up by hand. The external thread is within the permissible tolerance when the gaging face of the working ring gage is not more than one turn, large or small, from being flush with the end of the thread.

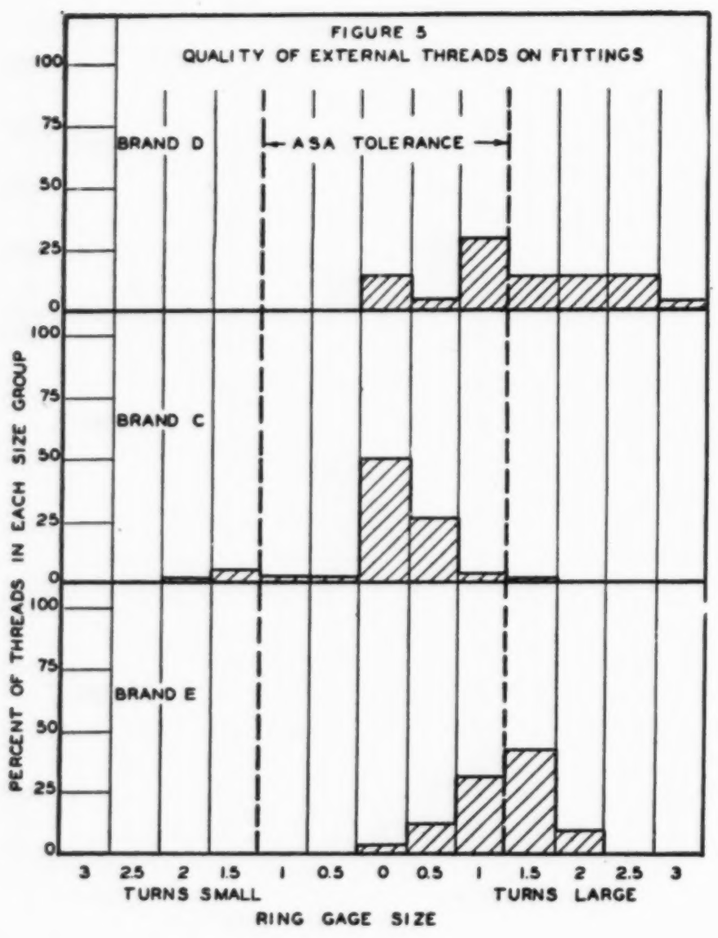
The method for gaging internal taper threads with the plug gage is shown in *Fig. 3.* The internal thread is within the permissible tolerance when the gaging notch of the working plug gage is not more than one turn, large or small, from being flush with the end of the threads. Special provisions are made for determining the start of the thread when the threads are chamfered or countersunk.

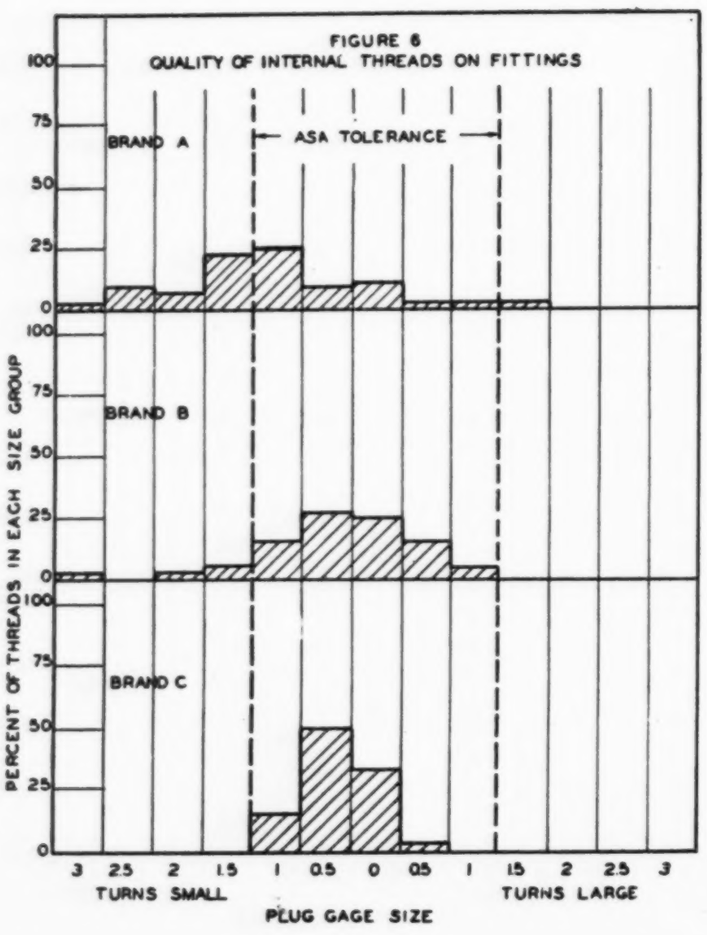
The allowable variation in product is one and one-half turns, large or small, from the basic dimensions due to a tolerance of one-half turn large or small on the working gage.

A few threads were gaged from each shipment of ¾-in. fittings and nipples received over a period of about two months. The threads were washed in kerosene and cleaned of dirt and loose metal cuttings by means of a small stiff-bristled brush. Motor driven wire brushes were also found to be suitable for cleaning. Each thread was lubri-

This paper was originally presented at a technical service group conference of the Pacific Gas Assn., Los Angeles, Apr. 28 and 29.







cated with a few drops of light oil before the gages were screwed up.

The quality and uniformity of external threads on nipples is shown in *Fig. 4*, that of external threads in fittings in *Fig. 5*, and that of internal threads on fittings in *Fig. 6*.

The external threads on nipples purchased from Vendor B were of the best quality, those of Vendor C were next best and those of Vendor A were of poor quality. Eleven shipments of Vendor B were sampled and a total of 344 threads were gaged. Nineteen shipments of Vendor C were sampled and a total of 384 threads were gaged. One hundred threads of Vendor A were gaged, all from one shipment.

The external and internal threads on Brand C fittings are of very high quality and uniformity. The threads on Brand B fitings are of next best quality. The other brands appear to be of lower quality.

Apparently there is considerable variation in the quality of some commercial pipe threads. It also seems possible for some concerns consistently to produce a very good quality product.

A great deal has been written about the troubles that manufacturers have in consistently producing threads of good quality. Some of the various causes of these troubles are given because they apply to hand threading as well as to power threading:

a. insufficient lubrication
b. dull tools
c. improperly sharpened tools
d. improperly adjusted tools
e. improperly lined up pipe
f. end of pipe not cut off square, causing diagonal threading

Test Results

The results of leakage tests of joints made using threads of various accuracies are given in *Fig. 7*. All the internal threads were within the ASA tolerance; the external threads were of various sizes.

External threads within the ASA tolerance were made up hand-tight plus three turns by wrench. Large external threads were made up hand-tight plus three turns by wrench and then tightened more if leakage occurred. Small external threads were made up to within one-half turn of the threads that are imperfect due to the chamfer on the die and then were tightened in increments of one-half turn.

The information in *Fig. 7* is a summary of tests of several thread dopes; however, it is impractical to give the detailed results here. It was evident that, although there are discernible

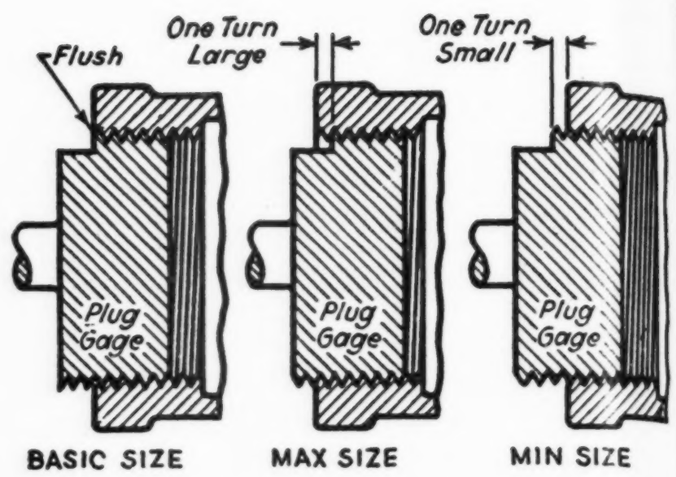


Fig. 3. Gaging internal taper threads with the plug gage.

differences in the sealing abilities of thread dopes, none of the 34 types tested could be expected to compensate for gross inaccuracies in thread forming.

ASA Tolerances

The type of thread mating that is obtained when both the internal and external threads are within the ASA tolerance and when the external threads are three turns small is shown in *Fig. 8*. The accurate external threads were screwed into the reducers and were made up hand-tight plus three turns. Eighty foot-pounds of torque were required to engage these threads. The contact between the flanks of the threads appears to be good. None of the imperfect threads on the nipple are engaged. Both of the joints were tight at an air pressure of 100 psig.

The joints at the elbow (external threads three turns small) were made up hand-tight plus one turn; both leaked. They were made up another one-half turn; one continued to leak and the other leaked within an hour.

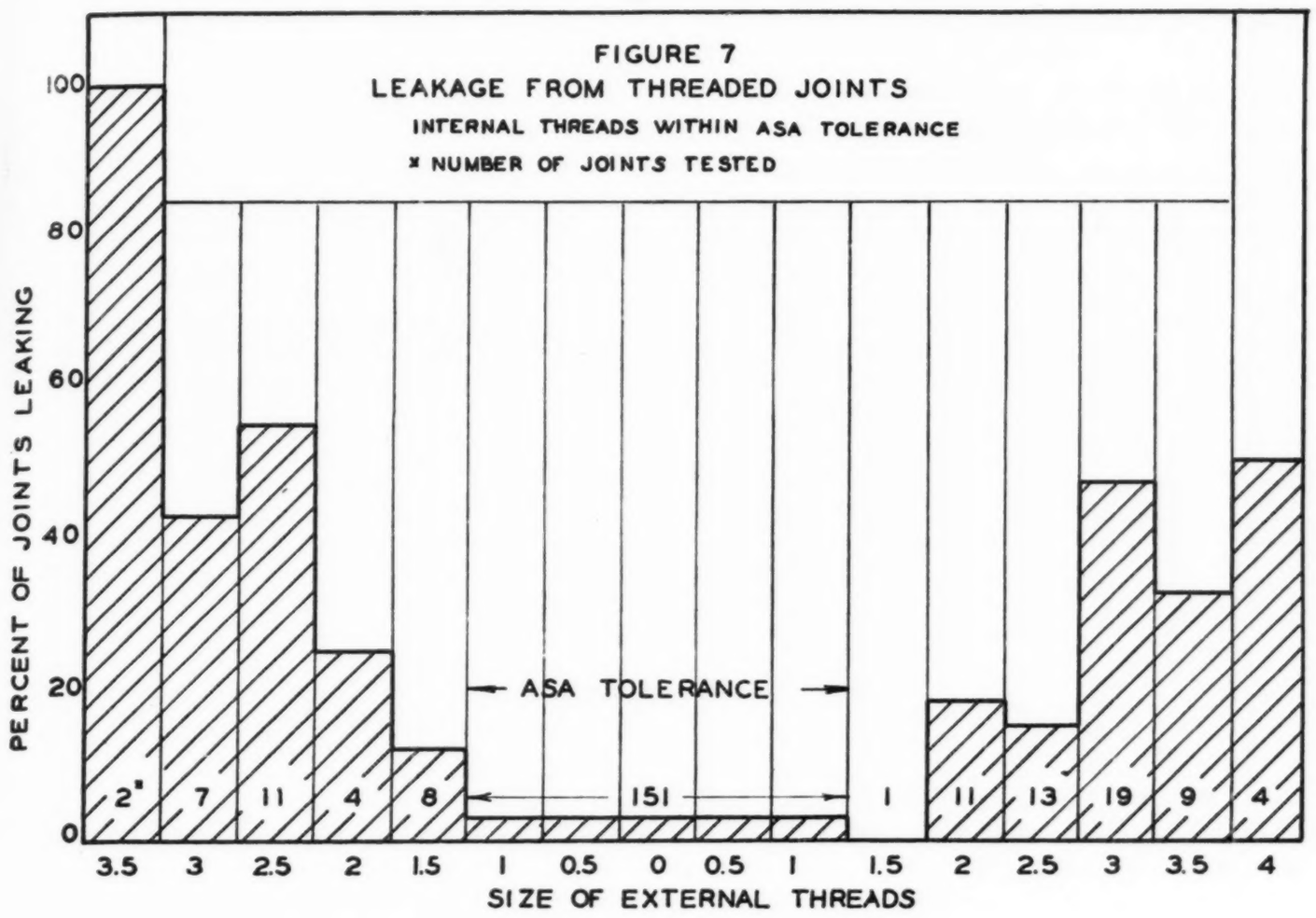
It appears that the flanks of the threads were not in contact except where the imperfect (last few) threads on the nipple are "mashed" into the internal threads of the elbow.

A large number of straight threaded couplings are in use. Cross sections of joints made with straight and taper threaded couplings are shown in *Fig. 9*. All threads are within the ASA tolerance.

No Leakage

The threads of the taper threaded coupling are well mated with the threads on the nipple. Twenty-eight of these joints were made up using a different thread dope on each assembly of four joints, and tested for leakage at 75° F and at an internal air pressure of 100 psig. There was no leakage after 10 minutes.

The threads of the straight threaded coupling do not appear to be in



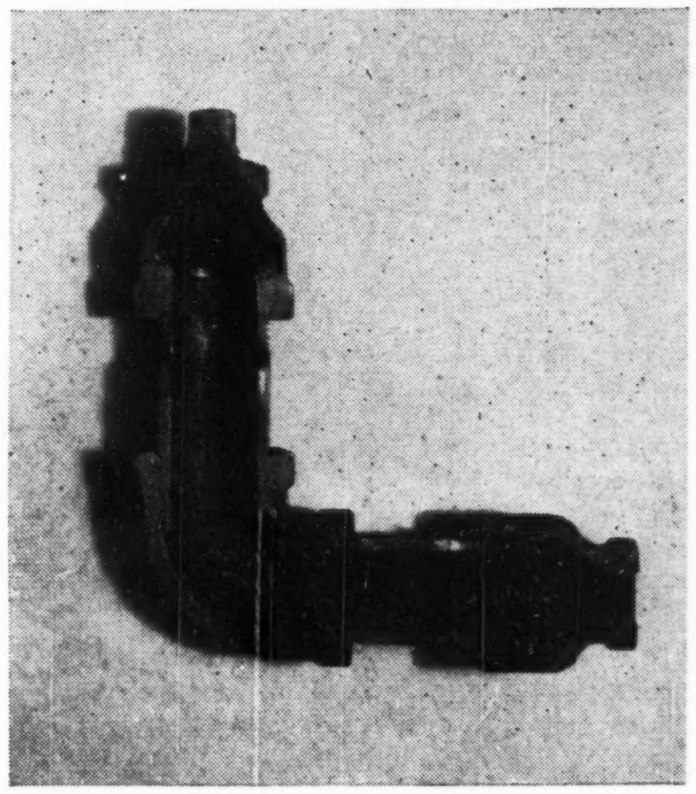


Fig. 8. Section of pipe joints showing threads that are gas tight (reducers) and threads that are not (elbows).

contact with those on the nipple, even at the flanks, except for the last thread engaged on the nipple. Twenty-eight of these joints were made up and tested in the same manner as the taper threads. Fourteen of the joints leaked within 10 minutes, which might be expected from a combination of taper and straight threads.

Caps Have Defects

Although relative to other fittings few caps are used, the actual number is quite large and many of them have defects that contribute to leakage.

Only two of the six caps shown in *Fig. 10* (bottom left and top right) conform to the ASA dimensions. The recessed inner construction allows additional make-up if needed to stop leakage. The other four caps have shoulders at the ends of the threads and production of a sealed joint depends upon the threads being mated when the exterior thread reaches the shoulder.

The cap (top-center) appears to be machined from bar stock. A large number of this type cap has been used at times. The threads have very little taper and are often shallow and flat crested. Only about 50% of these were within the ASA thread tolerance. Eight joints were made using good external threads. Three of the joints leaked.

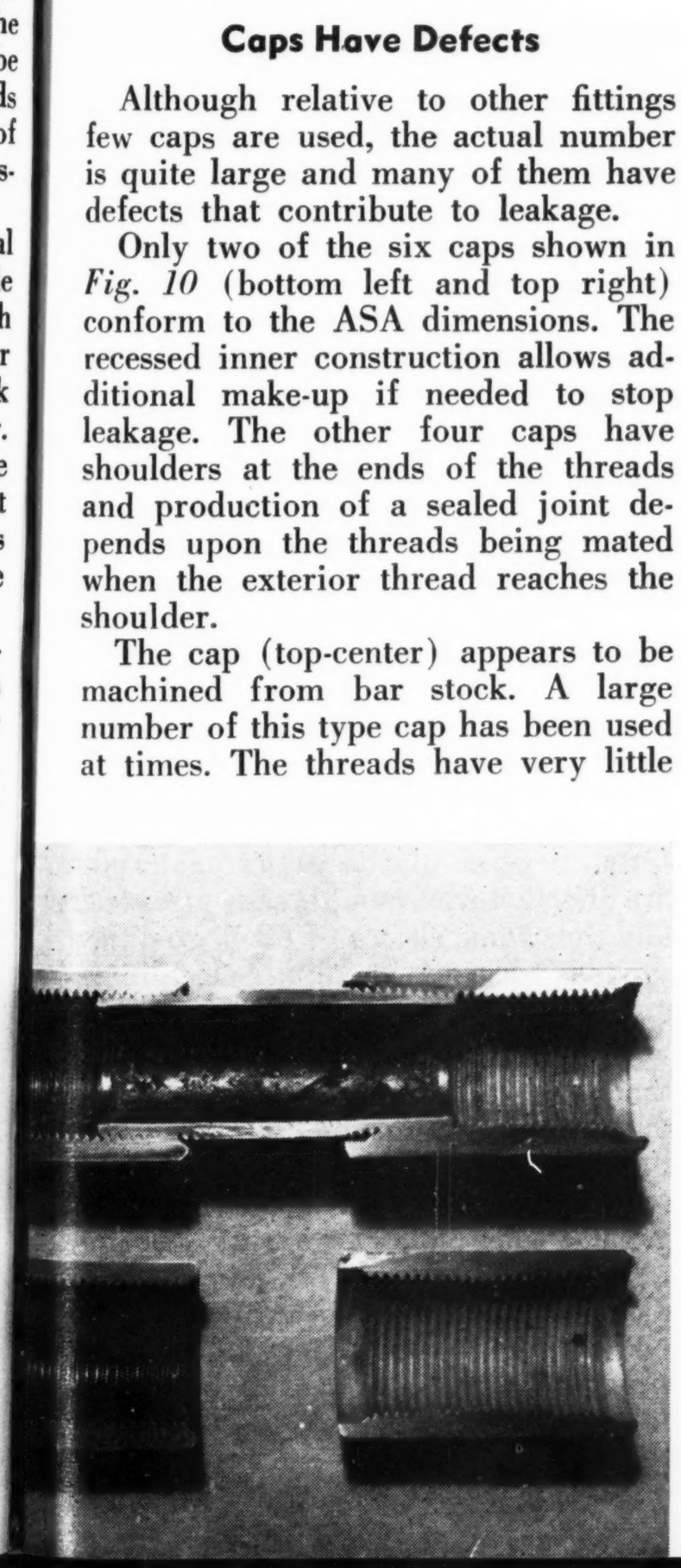


Fig. 9. Section of joints showing taper thread nipple with internal straight (lower) and taper (upper) coupling threads.

THREAD DOPES

THIRTY-FOUR thread dopes were tested for their ability to produce a sealed joint and keep it sealed under various conditions of use; however, it is not within the scope of this paper to give the extensive data.

It seems to be generally agreed that a thread dope is required to produce a gas-tight joint even when the best threads are used. One report presented before the American Petroleum Institute states that extreme accuracy of mating pipe threads is no assurance that the joint will be leak-proof against high pressure gas; another states that a thread especially made as perfectly as possible was a "bad leaker" when made up using light machine oil as the lubricant.

Requisites

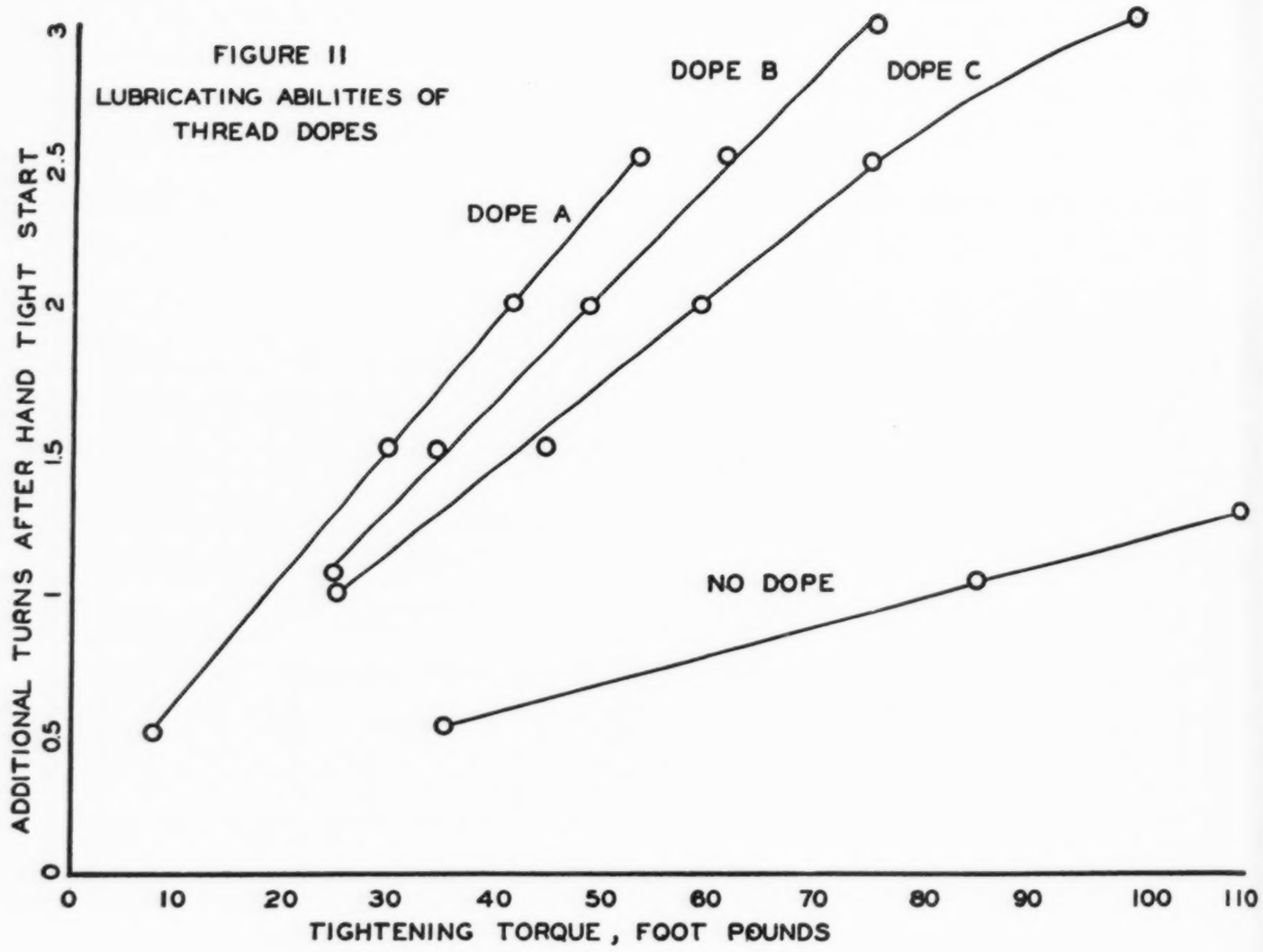
The production of an initially sealed joint depends upon having good threads to start with and since there are many possible combinations even within the permissible tolerances it is necessary that the threads be cold drawn into mating position during make-up. The efficiency of mating produced during cold drawing depends upon the threads being malleable and also upon the thread dope being a sufficiently good extreme pressure lubricant to prevent damage by galling and tearing dnring the process.

The lubricating abilities of three types of thread dope are shown in *Fig. 11*. It is also necessary that the filler, if one is used, be of such a nature that it will pulverize or flow if trapped between the mating thread flanks, thus allowing proper contact. The thread is truncated; consequently the thread dope should have enough body to act as a filler between the thread crests and roots even after the flanks are in contact.

Besides the lubricating and sealing requirements, there are other desirable properties of thread dopes. They should:

a. be easy to apply to threads at working temperatures
b. be clean, easily removed from hands and clothing (this is especially important when the fitter also keeps records)
c. not be affected by gas or water
d. not thicken or separate in containers
e. not harden in open container or form a film on top
f. keep threads from sticking for easy break-out
g. withstand vibration
h. be low in cost, and comparisons

Fig. 10. Sections of joints made with six types of caps. Bottom left and top right are the only ones conforming to ASA standards.



should be on a volume basis

The presently used procedure for comparing thread dopes is as follows:

a. All threads are cleaned to eliminate leakage that is caused by dirt or metal cuttings being trapped between the threads.

b. All threads are gaged so that their quality is known.

c. The joints are made up in a selected manner by counting the turns of hand and wrench make-up and by measuring the torque.

d. The joints are immersed in water at 70° F and subjected to increasing air pressure in increments of 10 psi at intervals of about 15 minutes until a pressure of 100 psig is reached. This pressure is maintained for several hours since time is an important factor with some materials.

e. The water in which the joints are immersed is gradually heated to a temperature of 150° F and is kept at this temperature for a few hours.

f. The water is cooled to 32° F and kept at this temperature for a few hours.

g. The water and the pipe assemblies are allowed to warm to room temperature and the joints are observed for leakage.

h. The joints are vibrated at known conditions for 100 hours. The joints are continuously pressurized with air at 100 psig during this test.

MAKE-UP

THE basic dimensions of pipe allow a different amount of hand-tight make-up for each size; following this a wrench make-up of three turns is allowed for 2-in. and smaller pipe, and two turns for larger pipe without going up on the imperfect thread where real make-up ends and "mashing" together begins.

The torque needed to make a ¾-in. joint is usually quoted at 60-65 foot-pounds. Our information seems to indicate that this is a minimum value consistent with that required when a very good lubricant is used. Many dopes make the torque requirements higher, even to 90-100 foot-pounds.

Pipe fitters frequently speak of being able to feel a joint come in. The slightly uneven pull as the thread irregularities are being cold drawn into position changes to an even pull after the flanks of the threads come together.

According to the literature thread damage is often due to too much make-up and on small pipe may be caused by "setting" the joint with a series of jerks after it is already mated. This method causes very large torques to be applied due to the weight of the body.

Making a joint up to a given point and then backing it off to align the piping is a cause of leakage since the already mated thread flanks are separated and the dope is required to flow back between them as well as seal the increased space between the crests and roots.

Handling Damage

Exterior threads are sometimes extensively damaged in handling, especially if they are transported in large sacks or if they are shoveled into sacks, barrels or bins. Mashed, torn and broken threads are visible to the naked eye. In many instances the damage is not this great, but sufficient to prevent gages from being started or screwed up. Damaged threads can be repaired to some extent with a small triangular file. This practice, however, removes thread metal and thus causes thread flank clearance and increases crest and root clearance.

It is not practicable to insist on high standards of thread formation or to spend time and money trying to find or develop thread dopes unless efforts are also made to minimize thread damage.

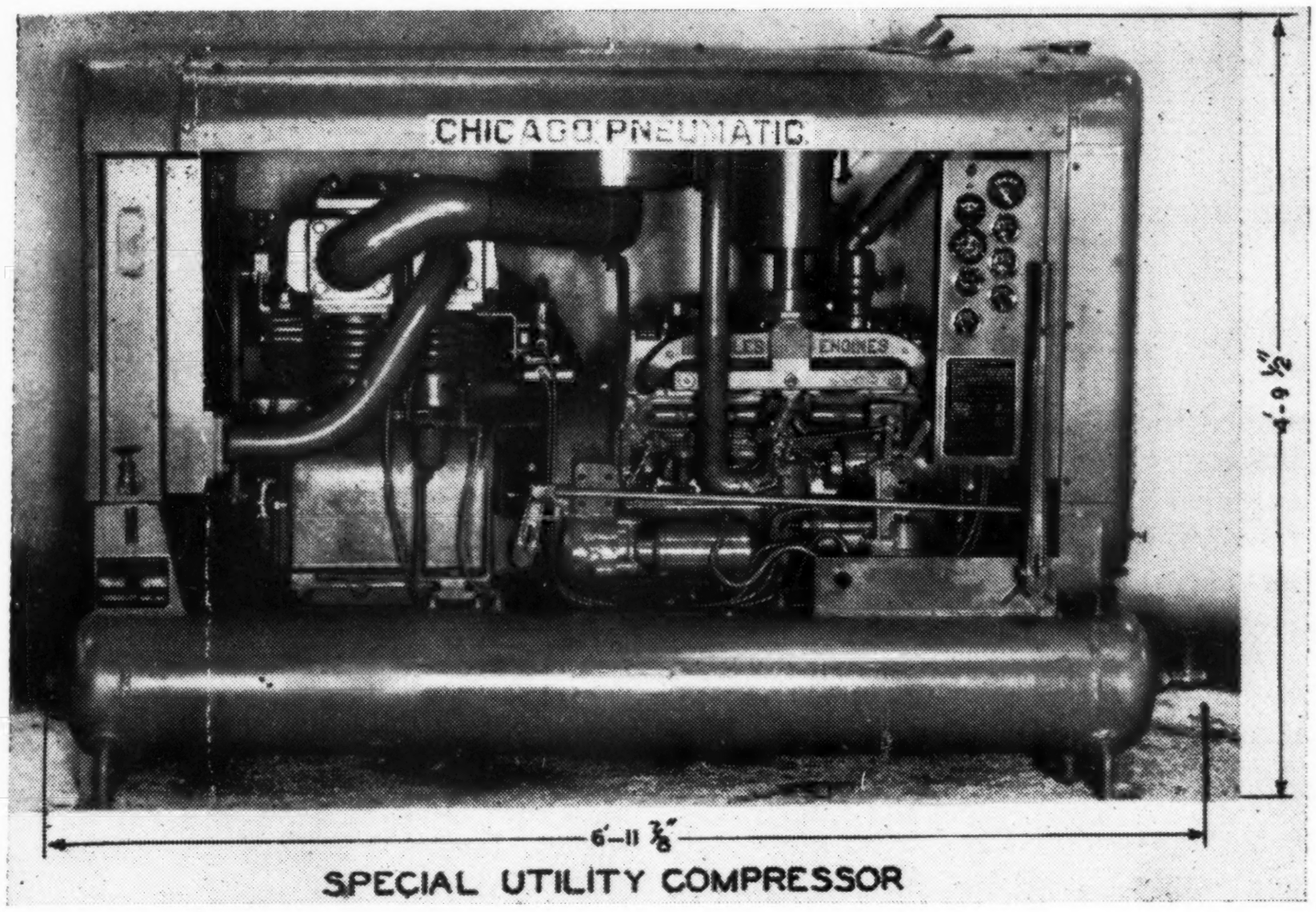
Rules for Guidance

1. The possibilities of reducing the number of leaks in threaded fittings lies mainly in getting threads of better quality and more uniformity in the hands of the fitters.

2. The thread dope cannot be expected to compensate for gross inaccuracies in thread form. There are some ineffective thread dopes regardless of thread form. Several of the better materials are effective when the threads are good and thus some choice of other qualities such as ease of handling, cleanliness and cost can be exercised.

3. Due to the large number of threads outside of the tolerance and to the many possible combinations within the tolerance it is not practicable to specify a given amount of thread engagement or make-up torque. The fitters' experience with the pipe wrench seems to be the best indication of the point where the joint comes in.

OPERATING IDEAS AND EQUIPMENT



SPECIAL UTILITY COMPRESSOR

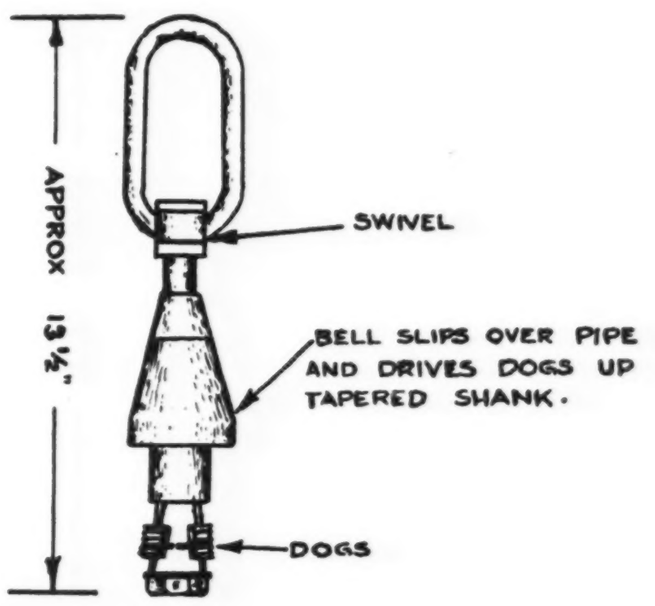
Two-Stage, 105-cfm Compressor Can Be Mounted on Truck

To answer the need of the utilities for a two-stage 105-cfm compressor that can be mounted transversely on a truck body, one manufacturer has remounted the air receiver and fuel tank on the conventional 105-cfm model. As shown in the photograph, the length of the compressor is reduced to less than 7 ft. The price of the revamped unit will be the same as the conventional skid-mounted model.

(Excerpted from a paper presented by J. R. Rensch, Coast Counties Gas & Electric Co., Concord, Calif., at the PCGA distribution conference.)

Clamp For Pulling Steel Pipe Devised

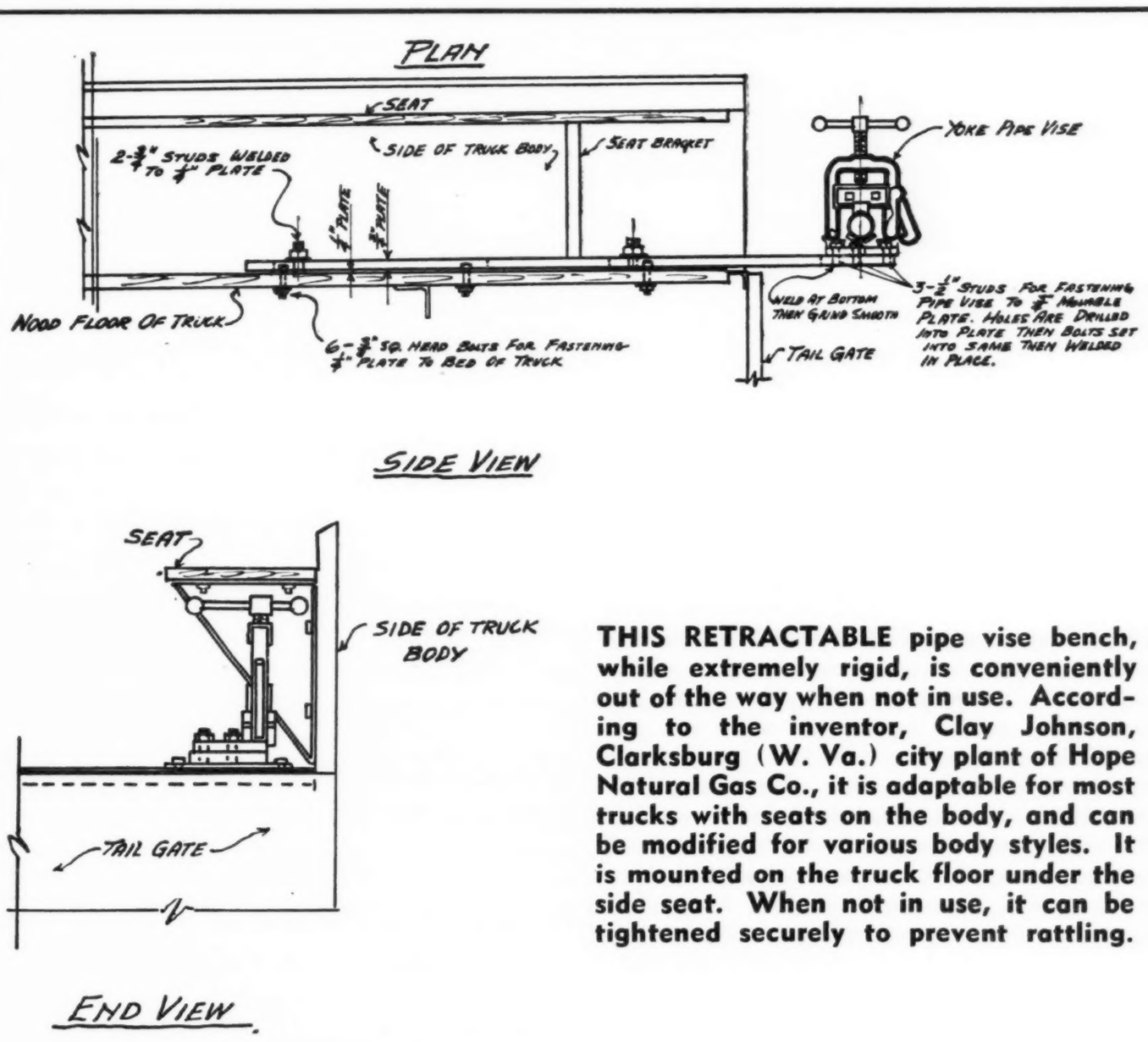
A clamp for pulling steel pipe has been developed and used successfully. As with the test head previously described, the grip is based on three dogs sliding up a tapered shank to clamp into the inside of the pipe. A swedge



2" GRIP

slides over the front end of the pipe section and prevents dirt from entering. The tow ring swivels to prevent twisting of the pipe. After the tugging operation, the clamp is easily removed. (For description of test head referred to, see *GAS*, October 1949, p. 53.)

(Excerpted from a paper presented by J. R. Rensch, Coast Counties Gas & Electric Co., Concord, Calif., at the PCGA distribution conference.)


PLAN
SEAT
SIDE OF TRUCK BODY
SEAT BRACKET
YOKE PIPE VISE
2-3/4" STUDS WELDED TO 1/4" PLATE
1/4" PLATE
1/4" PLATE
NOOD FLOOR OF TRUCK
6-3/4" SQ. HEAD BOLTS FOR FASTENING 1/4" PLATE TO BED OF TRUCK
WELD AT BOTTOM THEN GRIND SMOOTH
TAIL GATE
3-1/2" STUDS FOR FASTENING PIPE VISE TO 1/4" MALLEABLE PLATE. HOLES ARE DRILLED INTO PLATE THEN BOLTS SET INTO SAME THEN WELDED IN PLACE.
SIDE VIEW
SEAT
SIDE OF TRUCK BODY
TAIL GATE
END VIEW

THIS RETRACTABLE pipe vise bench, while extremely rigid, is conveniently out of the way when not in use. According to the inventor, Clay Johnson, Clarksburg (W. Va.) city plant of Hope Natural Gas Co., it is adaptable for most trucks with seats on the body, and can be modified for various body styles. It is mounted on the truck floor under the side seat. When not in use, it can be tightened securely to prevent rattling.

Groundwire For Electric Welders

An adequate groundwire for electric welding machines has been devised by H. L. Underwood Jr., Hope Natural Gas Co., Clarksburg, W. Va., and is now in use by welders of that company.

Past experience had shown that the welding machines had been inadequately grounded or not grounded at all, and that this condition perpetuated an injury potential that could have had serious consequences. Mr. Underwood's groundwire is constructed from a 5/8-in. round pointed steel pin, 2 ft in length. Two inches below the top, a 3/8-in. pole is secured for cable connection. On the opposite side of this pole is a "gusset" about 2 in. wide at the bottom, rounding to a flush connection at the top. This gusset is used only in prying or driving the steel pin out of the ground. Ten feet of 00 cable connects the pin to the frame of the welding machine.

Gas Combustion With Oxygenated Air

Studies of the use of oxygen as an industrial combustion agent

E. G. de Coriolis

By E. G. de CORIOLIS and JACK HUEBLER

Surface Combustion Corp.

(Condensed from a paper presented at the 31st annual convention of the American Gas Assn., held in Chicago Oct. 17-20.)

RECENT technological progress has resulted in the development of commercial oxygen plants which produce oxygen at such low cost as would make it appear that its use in industrial combustion processes might become feasible. Depending upon the size of the installation and other pertinent factors it would appear from recently published figures that low cost oxygen ranging from 20 cents per Mcf to 50 cents per Mcf is now or will shortly be available for commercial utilization. The purity of the oxygen which is made available by these plants varies from 95% to 97% oxygen, the remainder being nitrogen. Equipment now available makes it possible to hold the product gas to a reasonably constant analysis.

Although it is common knowledge that when air is enriched with oxygen for the purpose of combustion the flame temperatures generated are generally greater, there is very little concrete information available to the design engineer regarding the combustion properties of utility gases utilizing oxygen-enriched air. Of recent years considerable interest in utilizing temperatures higher than those normally obtained in gas-air combustion has been growing in a variety of fields. Because of the efficiency limitations of ordinary air-gas combustion in the temperature ranges above 2000° F, the utilization of utility gases has been in active competition with installations using electric power as a source of energy.

In order to analyze and evaluate the fields of advantageous use for oxygen-air-gas combustion of industrial gas, and to determine the present technical status and future technical needs of our industry in this intriguing field, the AGA Committee on Industrial and Commercial Gas Research has commissioned the laboratory of Surface Combustion Corp. to make an extensive engineering study of the subject. This research project, IGR-61, "Gas-Air Oxygen Combustion Studies" is a PAR plan activity.

Most industrial gas engineers have had no or very limited direct experience with burning gas with oxygenated air. This paper is a general outline of the subject and is designed to acquaint industrial gas engineers with the problems involved, the possibilities that are inherent, and basic design data. It is the first report on Project IGR-61 and will be followed by other reports as the studies progress and further data develop.

Generally speaking, the industrial gas engineer is primarily interested in natural and manufactured gas, although he sometimes deals with oils and other liquid petroleum products used commercially as fuels. He is now familiar with the combustion characteristics of these fuels, the temperatures attained, the burning velocities, and a large number of other details which form the basis for designing and successfully operating commercial processes utilizing these fuels. The present interest in cheap oxygen raises the question of how the ordinary design factors are altered when the air for combustion is enriched with oxygen. Such questions arise as: What temperatures can be attained when, for example, perfect combustion is maintained with natural gas and the oxygen content of the air varied upwards to pure oxygen? How are the burning characteristics changed? What ignition and maintenance problems are involved? What refractories can be used? What means of control are possible? What elements of safety must be included? What efficiencies can be obtained? And, finally, what is the cost?

Generally speaking, one may predict that with oxygen enrichment the flame temperatures that will be obtained will be higher, the ignition limits wider, and the combustion velocities greater, but specific information is required. From the all-important economic standpoint the engineer must be able to answer questions of the following nature. With the cost of natural gas at 50 cents per Mcf and the cost of oxygen at 25 cents per Mcf, if a furnace temperature of 2300° F is required, is it cheaper to use oxygen-enriched air, pure oxygen or air? Questions regarding the cost of the furnace, its desirability, and other similar factors come up, and it is impossible today without a great deal of laborious calculation to give these answers. Furthermore, it would be impossible for most industrial gas men to carry out the calculations which are involved without the loss of a great deal of time.

It was the purpose, therefore, of the AGA committee, in sponsoring the present research, to provide as fully as possible that information which is required to answer the above types of questions and to present it in a fashion which is desirable from the standpoint of engineering design. A part of this information is present in the literature, part can be calculated from fundamental data, while the remainder will necessarily be found only by experiment.

Although it will be possible as a result of the data being assembled in this study of gas-air-oxygen combustion to demonstrate the economics of oxygen utilization, the temperatres obtainable, and the combustion characteristics, there are a number of equally important problems to be solved. New burners will be required. Simple means for controlling the triple mixture of gas, air and oxygen must be developed. Furnace construction may be altered in regard to size, shape and burner placement. New safety procedures may be required. New ceramics will be re-

quired. In spite of the widespread work being done on refractories, the need for specific ceramic developments pointed toward this field is indicated. An additional associated problem is the influence of oxygen enrichment upon the noise generated during combustion. While it is not probable that solution to these problems will be immediately forthcoming, it is the present purpose to indicate the course ahead, based on a thorough study of presently known technical and non-technical facts.

Selling Commercial Gas Kitchens

Gasmen must sell auxiliary cooking equipment for counter use

By ELMER H. LERCH

Industrial Department
Rochester (N.Y.) Gas & Electric Corp.

(Condensed from a paper presented at the 31st annual convention of the American Gas Assn., held in Chicago Oct. 17-20.)

Elmer H. Lerch

YOU already know that counter cooking has always been the "toe in the door" that the electric industry has sought. Once having entered the establishment through the counter operation, they have often found it possible to get the major appliances. It is, therefore, important for the gas company to protect the counter load as a defensive measure against encroachments by the electrical competition on the major cooking load. In meeting competition we should strive to eliminate even one small electric appliance in such specifications which otherwise call for all gas equipment.

Certain gas counter appliances have distinct advantages over their electric counter-parts. For example, the gas broiler-griddle. This appliance is standard equipment in the roadside diner and is found in most other types of counter operations. Gas as a fuel for broiling is undisputedly preferable to electricity. The ceramic or alloy radiants in the gas broiler-griddle give a high, even heat that cannot be duplicated electrically. In fact, I do not believe the manufacturers of electric counter equipment make a counter broiler-griddle. In my experience I have never seen one and could not find one in the Food Service News' catalog of commercial electric cooking equipment nor in the Directory of Manufacturers of commercial and small industrial electric equipment published by the Edison Electric institute. These manufacturers realize that their equipment cannot do the job as well as their gas competitors and are smart enough not to beat their head against the wall by trying to compete. We should capitalize on this chink in their armor and shout the advantages of broiling for counter operations.

A couple of years ago when the electric matched-counter line was put on the market, there seemed to be a sort of defeatist attitude among gasmen. They felt that with this beautiful matched counter equipment, the electric boys would run off with the counter equipment market. To be sure, this matched line presents an attractive appearance, and tremendous strides in their sales have been made. However, *we* have some attractive gas counter equipment that we can point to with pride. Because of the nature of our appliances, it is not possible for us to simply set them on a counter with the same effect as can be accomplished with the matched line of electric equipment. In order to get the same effect, that is, a uniform height for all items, our equipment must be set up in such a way that the bases of the appliances are not at a uniform level.

At least one manufacturer of gas counter equipment has done an outstanding job of streamlining his complete set of counter items and putting them in a uniform set through the use of stands especially built for the appliances. This is the Anetsberger Bros. Inc. It might be wise for the gas industry to advocate that other manufacturers develop this type of assembly in order to allow for the variation in the height of the fryer, for example, as compared with the other equipment.

What can we do about the argument that the competition tosses at us that gas counter equipment is rigidly installed, which prevents easy accessibility for moving and cleaning?

In August 1946 a research bulletin was published by the American Gas Assn. telling about a gas plug-in flexible hose connector and suggesting an idea for a practical connector which had been developed as a result of the research at the AGA Testing Laboratories. The idea for this connector as suggested by AGA was taken up by a manufacturer who developed the idea to the point where a practical connector has been designed and built. There are several problems yet to be solved before this product is offered for sale. These problems have more to do with the maintenance of safe operation over a long period than with a reliable working design which the connector already has. The manufacturer has been slow to offer the product for that reason and also because he is not yet convinced that a demanding market exists for such a connector.

There have been many favorable reactions in investigations to determine the markets for this connector. Many people have felt as I do that, if well constructed and properly promoted, such a flexible hose connector would be a profitable item to produce, and would be in strong demand as being highly desirable to provide easy removal of gas counter cooking equipment for cleaning. The necessity for solid connections to gas counter cooking equipment has been a possible obstacle to their sale. The possibility of plug-in gas connection for counter appliances would at least eliminate a sales argument of our competitors.

I think all of you who believe with me that a plug-in flexible gas hose connector would help the sale of gas counter cooking equipment should write in to the Industrial and Commercial gas section of AGA offering to promote its use. It would help convince the interested manufacturer that the industry really wants this product. He would then be more inclined to get into early production of a plug-in gas connector.

If we are willing to recognize and admit that in electric counter equipment the electric boys have a few inherent advantages. I truly believe, and

(Continued on page 53)

CALORIC GIVES YOU

a long lead over competition

THESE 4 WAYS

1.

Most women who enter your store know what basic features they want in a range. And—

CALORIC OFFERS MORE FEATURES THAT WOMEN WANT

2.

But many prospects have some individual requirements, too. These are taken care of by the addition of optional features to a few basic models, 21″, 30″, 36″ and 40″. So for all practical purposes

EVERY CALORIC IS "CUSTOM-BUILT" TO THE OWNER'S NEEDS

3.

Three out of four women know the Caloric through more than 15,000,000 advertising messages appearing *each month* in national magazines and rural publications—the strongest advertising in the gas range industry. So—

3 OUT OF 4 PROSPECTS COME IN "SOLD" ON A CALORIC

4.

Caloric maintains 40 strategically located warehouses with overnight truck delivery. This enables you to limit your stock to a representative line of samples and order any required model from your nearby warehouse.

Caloric's liberal Financing Plan enables you to make *more* sales at *greater* profit with *less* capital outlay. So—

CALORIC CUTS YOUR COST OF DOING BUSINESS

All Caloric models are available factory-equipped for LP-Gas ("bottled" or "tank" gas) for use beyond city mains. "CP" features optional on all models.

CALORIC STOVE CORPORATION
Widener Building, Philadelphia 7, Pa.
Exclusively Gas Range Manufacturers

REPLACEMENT OR REFUND OF MONEY
Guaranteed by Good Housekeeping
IF NOT AS ADVERTISED THEREIN

Ultramatic Caloric® Automatic Gas Ranges

America's Easiest Ranges to Keep Clean

(Continued from page 45)

am convinced that what we have to offer surpasses by far the claims made by the electric industry. We have a decided advantage in our fuel for short order cooking, because its very name, "short order" implies speed. Our equipment heats up quickly, particularly our hot plates where the heat is available immediately. We have thermostatically controlled griddles large enough to make it practical for the cook to prepare his hamburgers and hots in advance and keep them warm on one section while continuing to cook on another section.

"Problems Solved at Washington"

Utility executive discusses obstacles his company faced at war's end

By HOWARD B. NOYES

Vice President, Washington (D.C.) Gas Light Co.

(Condensed from a paper presented at the annual meeting of the New Jersey Gas Assn., Spring Lake, N. J., Sept. 9.)

THE net result of post-war developments in the Washington Gas Light system was that continuation of the 600-Btu mixed gas heating standard would have necessitated the outlay of vast amounts of money to construct new production and distribution facilities at a time when materials were scarce and construction prices were high.

We were confronted with still another major problem at the end of the war. Our operating expenses were beginning a much faster climb than our operating revenues due to the rapid increase in prices of production raw materials and of labor costs. We had been able to maintain our gas rates to our customers at substantially 1939 levels. There was every prospect, however, that unless some drastic economies could be effected, our rates would have to be substantially increased to compensate for the mounting operating expenses and the large amounts of additional capital outlay necessary to expand our gas service.

Decision Reached

It was then, the early part of 1946, that we decided to change our system to the distribution of straight natural gas. This step solved, or at least partially solved, many of our perplexing problems. The gas supply situation reflected a long-term picture since the reserves in the Appalachian area had been reinforced by pipelines from the vast Texas fields. Following the completion of our changeover in 1947, our gas plants were then the natural gas wells located in Kentucky, West Virginia, and 1200 miles to the south in the east and coastal plains of Texas.

We dismantled one of our plants that year. Generating equipment in the larger and more modern East station was converted to produce an oil gas with a heating value of approximately 1030 Btu.

It was imperative, since actual gas production would take place during only a relatively short period each year, that the generating equipment be readapted to produce a supplementary gas at the lowest possible investment cost. For infrequent operation, high materials costs are of relatively minor importance as compared to fixed investment charges. This problem was solved by making rather simple changes to the equipment which permitted the heating of the apparatus and the production of oil gas by the use of gas oil exclusively. The total cost of converting 14 water gas sets was $66,000. This exclusive use of liquid gas production material has resulted in extreme flexibility of operation and has aided in maintaining standby expense at a minimum level. Details of the process were published last year in the technical gas literature.

Changeover Problems

In 1946, prior to our changeover, our maximum daily output had been 100 MMcf of 600-Btu gas. During this coming winter our estimated maximum daily output, based on an average daily temperature of 5°, which is the design temperature for our system, is 133 MMcf of 1100-Btu gas. Manifestly this more than doubling of our maximum daily thermal gas output within a period of four years could only have been accomplished by the changeover to natural gas.

The changeover to natural gas, of course, had the immediate effect of almost doubling the thermal capacity of our distribution system. An example of how one knotty distribution problem was solved may be cited in the case of our suburban Virginia area. Prior to the changeover there three years ago the design maximum daily load in that territory was approximately 9 MMcf of 600-Btu gas. During the coming winter we estimate that the maximum daily load will be 18 MMcf of 1100-Btu gas. We have had to install substantial footage of additional gas mains in this section to reach new customers. However, in designing a new natural gas transmission line to bring additional gas to the Washington system, we routed this line so that it would enter the system through the outlying sections of the Virginia territory, thus bolstering a long extended distribution system by the installation of pressure regulator stations on the transmission line at selected points enroute.

Volume to Therm

At the time of the natural gas changeover we converted our then existing volume gas rates to an equivalent therm basis. It was hoped that our changeover would prevent the necessity

JAMES F. OATES JR.

NEW PEOPLES EXHIBIT

When Peoples Gas Light & Coke Co., Chicago, begins celebration of its 100th year of gas service next September, the event will be marked by the dedication of a $100,000 permanent gas industry exhibit at Chicago's Museum of Science and Industry.

The announcement of this undertaking, made at the AGA convention in October by James F. Oates Jr., chairman of the board, elicited a two-point resolution that the 1950 fall meeting of the association executive board meet in Chicago and that five distinguished non-Chicago gasmen represent the industry at the ceremony.

Over 1 ½ million persons per year will see the exhibit, which will stress modern production and utilization, with the historical aspects of the fuel being depicted in interpretive background material. Animated devices will operate to show visitors the various steps in producing and distributing coke oven and natural gas.

In addition to the miniature process displays, full-size models of gas-fired home appliances, meters, and controls will visually show their operation and a complete kitchen will be set up to demonstrate the latest in functional arrangement.

of seeking higher rates, and that future operating conditions might even result in a lowering of gas costs to our customers. However, we were unable at that time to make any accurate estimate of the extent of the economic inflation which was to occur. As a result of four rounds of wage increases, the high construction costs of new distribution facilities, as well as an increase in the costs of all other elements in our business with the exception of natural gas, we have been forced into a position where our present earnings are inadequate. An application was therefore made this past July for an increase in gas rates in the District of Columbia of approximately 7%. Hearings on this application which have been conducted by the public utilities commission have been recessed to a later date.

The problem of rates was a matter which required serious attention and careful handling. We had decided to introduce the so-called "therm" rate structure for several reasons. In the first place, we planned no immediate rate reduction or rate increase. It was felt that our new rate schedules could best be explained to our customers if we educated them to the concept that they were buying heat units of gas.

Another compelling reason for the adoption of the therm rate is the fact that our gas supply is furnished from several sources. Natural gas originating in the West Virginia and Kentucky fields may have a heating value varying from 1000 Btu to 1180 Btu per cubic foot. The calorific content of the Texas gas received in the Appalachian area is in the neighborhood of 1050 Btu. Consequently, the heating value of the gas which we have distributed during the past several years has ranged from a minimum of approximately 1060 Btu to a maximum of about 1180 Btu.

Storing Btu's for Peak Loads

A summary of costs, investments and comparative limitations

By PHILIP S. PARKER

Stacey-Dresser Engineering Co.,
Cleveland

(Condensed from a paper presented at the 31st annual convention of the American Gas Assn., held in Chicago Oct. 17-20.)

A brief review of the significant figures of storage processes that are already in commercial use or that have been developed to the point that successful operation is assured and reliable data and costs are available is given in *Table 1* with the peak load application most fitted for the particular scheme of storage. In the table investment costs and annual costs are for the combination of items and operation to best fit the peak load application noted.

Our major peak load problem is the seasonal peak load and for heavy use at an economical level, outside of natural underground storage, we find only liquefaction is available. LP-Gas-air mixture and catalytic reforming due to their high unit cost of gas compared to normal base load gas, must usually be confined to peak load shaving. It has been shown that with propane at 10 cents per gallon the use of LP-Gas-air mixture is usually economical up to about 2% of the total base load of gas. Six-day full capacity operation or its equivalent has been selected as the optimum LP-Gas-air operation period.

Catalytic reforming produces a completely interchangeable gas and if plants are placed on strategic points on the distribution lines will show economy for operation period of from 30 to 60 days. The 30-day operation figure has been used for catalytic reforming figures. The heavy oil process for high-Btu is of the type that, to get the full advantage of low cost operation and proper credit for tar by-product use, should not be intermittent; and it is looked on as a continuous winter operation to increase base plant load during this period. The figure given is for 90 days operation but would probably increase considerably for shorter periods or intermittent operation.

Cost Comparisons

However, gas produced in converted sets using gas oil feed shows economy for peak load shavings if necessary equipment is available for conversion. Operating labor costs are higher than LP-Gas-air mixture or catalytic reforming and amount of investment cost for individual conversion must be determined to obtain final unit gas cost for this method.

The figures in this summary emphasize the well-known fact that there is no one answer for all peak load problems. In fact most firms have found that a combination of several methods fits their particular needs, with emphasis varying from one method to another depending on local conditions. For the most economic solution, each individual problem must be carefully analyzed and it is hoped that the data presented in this paper will be of some assistance in making any such analysis.

TABLE 1. COMPARISON AND APPLICATIONS OF STORAGE PROCESSES

Type Storage	Unit Size MMcf	Max. Storage MMcf	Total Investment Cost $/Mcf Stored	Total Annual Cost $/Mcf Handled	Uses or Cycles Per Year	Peak Load Application Application
Gas Holder	10	.....	156	.08	200	Daily
Sphere	½	.....	227	.12	200	Daily
High Pressure	½	50	48	.29	25	Weekly
Underground	....	65,000	.50	.20	½	Heavy Seasonal
Liquefaction	50	1,000	13	.25	4	Heavy Seasonal
LP-Gas-Air 1000 Btu	....	250	7.50	1.70	6 days	Seasonal Shavings
Cat. Ref. 1000 Btu	....	300	3.75	1.54	30 days	Seasonal Shavings
Heavy Oil 1000 Btu	....	.....	.....	.57	90 days	Seasonal
LP-Gas-Air 530 Btu	....	470	4.00	1.07	6 days	Seasonal Shavings
Cat. Ref. 530 Btu	....	300	3.40	.98	30 days	Seasonal Shavings

Get set for the *exciting new* Servel in '50! Just listen! A new classically simple exterior . . . designed to stay modern . . . never to "date" a kitchen. Just think! A new quick-change interior . . . adjustable to turkeys or tall bottles in stop-watch speed. And that's not all! Servel for '50 has *everything!* So get set! Plan your promotions early! Because . . . THE NEW SERVEL means plenty of business for you in '50!

Watch the next issue for more details

SERVEL-sell-bent for '50

ASSOCIATIONS

OIL IMPORTS THREAT

Curb vital to gas, INGAA decides at annual meet

HOW heavy imports of oil are threatening the future well-being of gas utilities as well as gas pipeline companies was demonstrated in a resolution adopted in Dallas, Oct. 31 by the Independent Natural Gas Assn. of America. Acting as gasmen rather than as oilmen—which some of them are—the 200 executives in attendance at the annual meeting adopted a resolution expressing strong opposition to the importation of petroleum or petroleum products "in an amount that would displace natural gas as a fuel for industrial purposes."

The motion, put forth by Marshall Newcomb, Lone Star Gas Co., Dallas, followed this general logic:

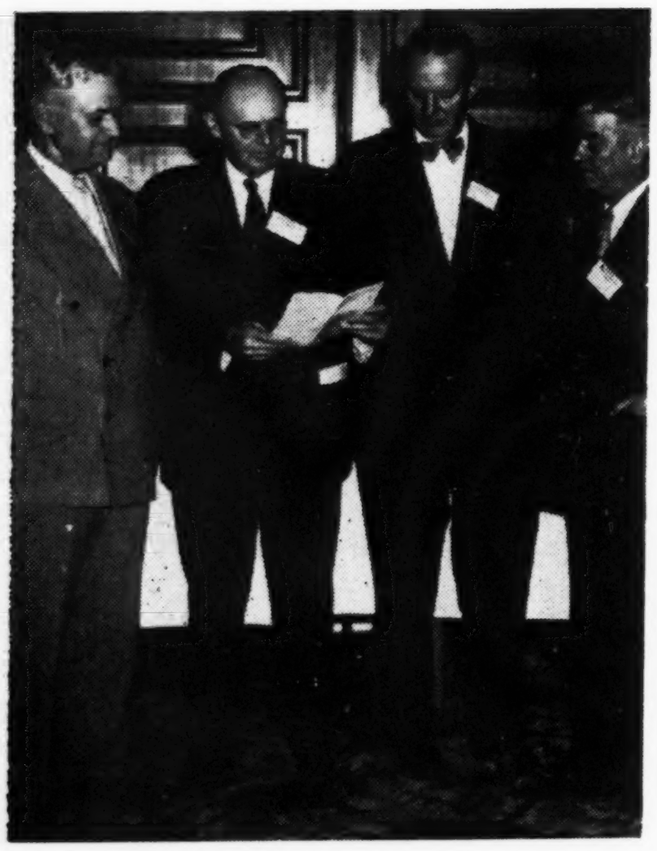
1. Natural gas, oil, and coal are fundamentally competitive, and maintain a sort of shifting balance dictated chiefly by price.

2. Gas consumption has increased tremendously, while its price has decreased substantially. This cost trend has been largely due to the high load factor achieved through interruptible sales at low prices. (In 1946, 46% of all gas consumed in the U.S. was for industrial use.)

3. In the industrial market natural gas is directly competitive with residual fuel oil because of price. Skidding oil prices in the past year have brought a swing back to oil by industry. Importation of oil has contributed to the oversupply which has caused this.

4. This changing price relationship will disturb the balanced operation of natural gas distribution and transmission to the detriment of the householder.

5. Therefore, importation must be limited.



New INGAA officers pictured at Dallas meeting are, from left, Homer Long, first vice president; Clyde Alexander, new president; C. P. Rather, second vice president; and John A. Ferguson, executive director. Missing is F. W. Peters, treasurer.

The resolution further authorized the establishment of a committee to study the situation.

The subject of competitive price relationships received a thorough working over in other papers presented at the one-day meeting. S. B. Irelan, president, Cities Service Gas Co., Oklahoma City, decried the "give-away price" of natural gas which is causing its inordinate growth. His talk, titled "Winter Supply Problems of Transporters," dealt chiefly with the many facets of the peak load problem.

G. A. Staples, The Chicago Corp., Corpus Christi, Texas, also took up the subject of winter supply problems, but from the standpoint of the producer and gatherer. He pointed out the excellent results of field proration, discussed the methods of preventing gas hydrate freezeups, and told of difficulties encountered in metering and in constructing facilities during the winter.

Frank H. Dotterweich, Texas College of Arts & Industries, Kingsville, thoroughly reviewed recent and current price trends in a talk titled "Competitive Position of Natural Gas vs. Coal, Fuel Oil, Manufactured Gas, and Atomic Energy." He predicted a continued swing to natural gas and a negligible effect upon its growth of the introduction of atomic energy and other new fuel processes.

While asserting that off-shore Gulf reserves of natural gas are probably sizeable and pointing out that the laying of gathering and transmission lines is feasible, Major B. A. Hardey, Shreveport, La., pointed out that the cost of such installations would run from two to four times that of similar dry-land lines. Exploration costs, too, are extremely high. But in the final analysis, whether the reserves are sufficient to pay for the installation is the important question.

Major Hardey also presented some recommendations for regulating production.

Wesley E. Disney, INGAA general counsel, gave members a picture of pending law-making with "A Look Into the Legislative Future." Rex Baker, Humble Oil & Refining Co., Houston, detailed some current developments in the legal field. Marshall Newcomb explained the ramifications of Texas' standard gas measurement law.

President A. B. Harper, Arkansas-Oklahoma Natural Gas Co., gave a report of activities and accomplishments.

New officers for the ensuing year include Clyde H. Alexander, Creslenn Oil Co., Dallas, president; Homer Long, Guymon, Okla., first vice president; C. P. Rather, Southern Natural Gas Co., Birmingham, second vice president; F. W. Peters, Oklahoma Natural,

With the Largest Exhibitor at the World's Largest Show

Above are two scenes from the "largest show in the world"—the National Metal Congress at Cleveland, the week of Oct. 17—at which 68,000 persons viewed new metalworking equipment. Gas was in its glory, with 10 manufacturers joining to give AGA the largest single exhibit. At left are the Sellers and Gas Machinery Co. exhibits showing respectively immersion-fired boilers and a carborundum radiant tube for high-temperature furnace heating.

Another highlight of the show was the demonstration of a gas safety control system by Associated Factory Mutual Fire Insurance Co.'s which utilizes a manual reset valve in case of failure of gas supply or electrical supply to controls.

At right is the speakers table at the traditional industrial gas breakfast. From left are G. W. Horsley, East Ohio Gas Co.; E. L. Shaner, editor, *Steel,* and guest speaker; C. H. Lekberg, incoming industrial section vice-chairman, who presided; Dr. Oscar L. Harder, Battelle Memorial Institute and past president, American Society for Metals.

The Sales Appeal of Work-Saving KNOWS NO SEASON!

Right now—in your community—hundreds of men have that "gift-for-the-household" idea in their minds. They're thinking of buying something important and useful for their families for Christmas, *besides* all the "Christmasy" personal gifts.

Plenty of them will buy Hamilton Clothes Dryers if their Hamilton dealer puts the proposition to them properly. Other Hamilton Dealers are doing it. So can you.

There's a big package of SPECIAL CHRISTMAS SALES PROMOTION tools available for every Hamilton Dealer. Get yours—and GET YOUR SHARE of the December business that's WAITING TO BE ASKED FOR!

[PICTURE OF A WOMAN HANGING OUT THE FAMILY WASH—HAMILTON STYLE]

Hamilton

THE ORIGINAL AUTOMATIC

CLOTHES DRYER

(GAS MODELS)

The Hamilton market is a PLUS market. It's extra—over-and-above all your other appliance markets. It's new, fresh, uncluttered with trade-in headaches. It's a feeder for washer sales, actually, because it makes home laundering so much easier it wins people away from sending their wash to the laundry. If you handle *any* washer or ironer lines, you owe it to your business to line up with Hamilton, and enjoy the added profits you'll earn from selling one of the most *wanted* of all major appliances. Write today—

HAMILTON MANUFACTURING COMPANY, TWO RIVERS, WIS.

In Canada the Hamilton Dryer is known as the Coffield-Hamilton Automatic Clothes Dryer, and is distributed by Coffield Washer Co., Hamilton, Ontario

5 Separate Surveys Tell the Story!

Here's proof that the Hamilton Automatic Clothes Dryer IS one of the most *wanted* of all major appliances.

"1 out of 4"

Out of 7,000 families *in all income groups* questioned by a leading newspaper, 23.6% of the women stated that they wanted an automatic dryer.

"28% Build for It"

Of 4,900 home plans studied, BETTER HOMES & GARDENS Magazine reports 28% of planners had specifically *asked* their architects to provide a place for a Clothes Dryer.

9½% of Home Owners

McCALL'S Magazine found that 9½% of 11,887 home owners asked said they wanted to buy Dryers. They wanted Dryers at the rate of 1 Dryer for every 3 washers!

15.9% Order Dryers

A foremost electric appliance company, in a package-deal made to 1,000 G.I. customers, arranged for them to order extra equipment, if they wished—and 159 out of the 1,000 or 15.9% ordered Dryers. They ordered Dryers at the rate of 1 Dryer to 3 washers!

The Girls want Dryers

A survey of girls at Stephens College showed more of them wanted Dryers in their homes than ironers—and that just as many wanted Dryers as wanted washers!

19 million readers of these great national magazines . . .

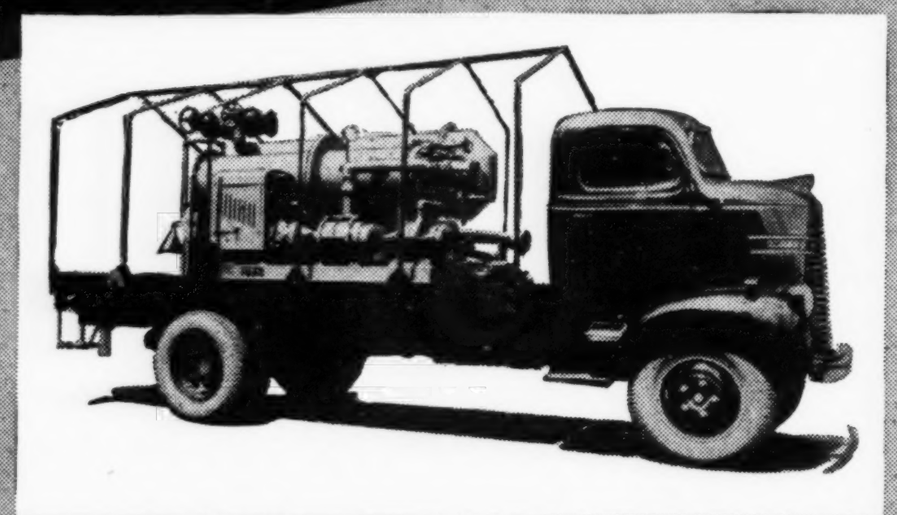
—are being told and retold, reminded repeatedly, persuasively, of how much comfort and convenience a Hamilton Dryer will mean to them.

as advertised →

—in Good Housekeeping, The Saturday Evening Post, Better Homes and Gardens, McCall's, House Beautiful, Parents, American Home, Small Homes Guide.

FOR PORTABLE OR STATIONARY PROTECTION...

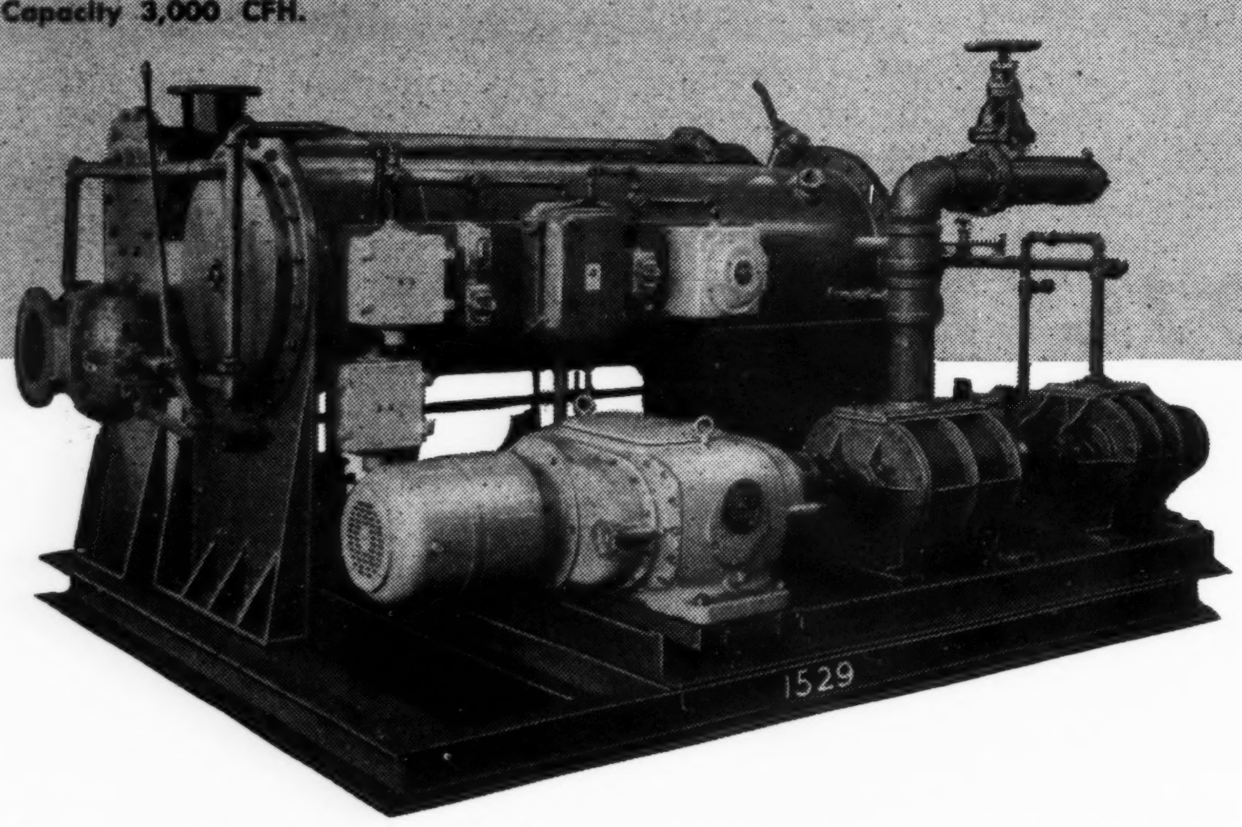
R-C Inert Gas Generators



Portable R-C Inert Gas Generator, of 15,000 CFH capacity, mounted on pneumatic-tired truck.

★

Stationary R-C Inert Gas Generator mounted on steel base. Capacity 3,000 CFH.



You can reduce the hazards of processing, handling or storing inflammable gases or liquids with R-C Inert Gas Generators. They produce cheaply a mixture of nitrogen and carbon dioxide, using oil or gas as fuel. Both fixed and portable units have these outstanding advantages:

1. Large capacity in terms of weight and cost.
2. Low operating and maintenance cost.
3. Quick adjustments for complete combustion.
4. No adjustments, for same fuel, needed after shut-down.
5. Operation not affected by variation in back pressure.
6. Extremely quiet operation.

With capacities from 1,000 CFH to 50,000 CFH, R-C Inert Gas Generators provide quick, dependable protection, at low cost. They are equally efficient, also, for inert gas production for processing operations. Write for details in Bulletin 100-B-14.

ROOTS-CONNERSVILLE BLOWER CORPORATION
912 Oregon Avenue, Connersville, Indiana

ROOTS-CONNERSVILLE

BLOWER BUILDERS • R-C • SINCE 1854

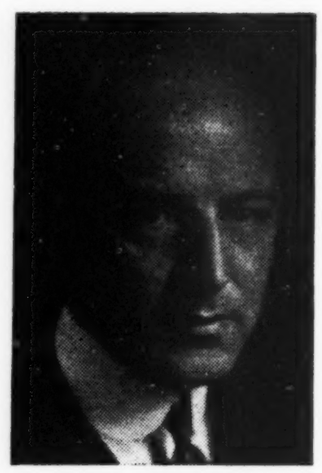
BLOWERS • EXHAUSTERS • BOOSTERS • LIQUID AND VACUUM PUMPS • METERS • INERT GAS GENERATORS

★ ★ ONE OF THE DRESSER INDUSTRIES ★ ★

Tulsa, treasurer; John A. Ferguson, executive director.

New directors include J. J. Hedrick, Natural Gas Pipe Line Co. of America, Chicago, and Claude A. Williams, Transcontinental Gas Pipe Line Corp., Houston. Re-elected to directorships were Joseph Bowes, Oklahoma Natural; N. W. Freemand, Tennessee Gas Transmission, Houston; D. D. Harrington, Hagy Harrington & Marsh, Amarillo, Texas; Paul Kayser, El Paso Natural, Houston; Mr. Long; Mr. Rather; and W. H. Wildes, Republic Natural, Dallas.

Lab Committee Loses Whitwell



Geo. E. Whitwell

George E. Whitwell, who for 21 years had served on the AGA Laboratories' managing committee, resigned last month and was succeeded by Ernest R. Acker, president and general manager of the Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y.

Mr. Whitwell, who is vice president in charge of sales for the Philadelphia Electric Co., was a senior member of the committee and served as its chairman from 1941 to 1946. Although he had wanted to retire for some time because of the pressure of other duties, he had carried on through the war as chairman and stayed on afterwards to help with postwar readjustments. He has been active in many other phases of AGA work.

Mr. Acker is a former president of the AGA, having served in 1944. He has been vice chairman and chairman of the commercial section as well.

Approval Group Honors Geyer

H. W. Geyer, utilization engineer for Southern Counties Gas Co., Los Angeles, was recently honored with the presentation of an engraved resolution and commendation by the subcommittee on approval requirements for gas water heaters of the AGA.

Mr. Geyer, who has served with the group since 1933 and has been chairman since 1941, has withdrawn from some of his association activities because of important new assignments. He has been very active in both the AGA and PCGA in committee work on gas appliances.

ASHVE Nominates Avery

Lester T. Avery, president of Avery Engineering Co., Cleveland, has received the nomination for the presidency of the American Society of Heating & Ventilating Engineers. Election will take place at the society's 56th annual meeting in Dallas in January.

Other candidates include Lauren E. Seeley, University of New Hampshire, for first vice president; Ernest Szekely, Bayley Blower Co., Milwaukee, second vice president; and Reg F. Taylor, Houston, for treasurer.

GAMA Division and Group Chairmen Selected

New chairmen of GAMA's divisions and groups were recently named by President Stanley H. Hobson, George D. Roper Corp. Their installation took place during the AGA convention in October.

The new chairmen are J. F. Ray, General Controls Co., controls & related accessories division; L. O. Reese, Armstrong Products Corp., direct heating equipment division; W. H. Muhlbach, Florence Stove Co., domestic gas range division; H. E. Jalass, Cribben & Sexton Co., "CP" manufacturers group; C. H. Rippe Jr., Hamilton Manufacturing Co., gas clothes dryer division; I. E. Seith, The Forest City Foundries Co., gas house heating and air conditioning equipment division; John K. Knighton, Servel, gas air conditioning group; H. C. Day, American-Standard, gas boiler group; J. V. Rerucha, The Columbia Burner Co., gas conversion burner group; Russell M. Cook, Thatcher Furnace Co., gas furnace group; L. A. Brand, Empire Stove Co., gas floor furnace group; J. W. Hebert, Calcinator Division, Valley Welding & Boiler Co., gas incinerator division; Floyd Gaunt, Reynolds Gas Regulator Co., gas meter and regulator division; Louis Ruthenburg, Servel, gas refrigerator division; Philip S. Harper, Harper-Wyman Co., gas valve division; Leland M. Feigel, Servel, gas water heater division; E. J. Horton, Robertshaw-Fulton Controls Co., hotel, restaurant and commercial gas equipment division; Alvin M. Stock, The Partlow Corp., industrial gas equipment division.

Plant Cooling Symposium For NGAA Meeting

Operating problems, including a symposium on plant cooling, will be discussed at the third annual Natural Gasoline Assn. of America meeting for the Panhandle Plains area in Amarillo, Texas, Dec. 9.

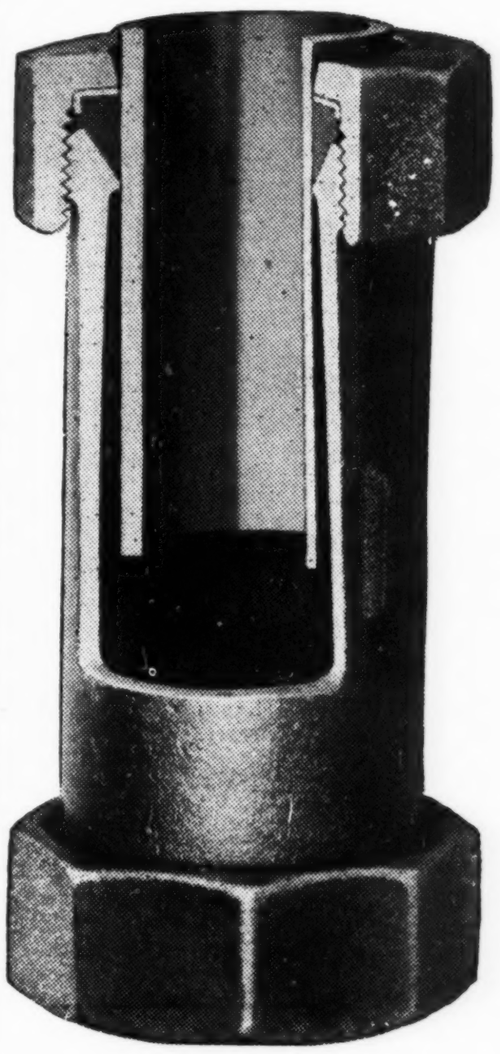
Harry Wheeldon, Shamrock Oil & Gas Corp., Amarillo, has lined up a program of eight papers for the one-day session. Air cooling equipment, water cooling towers, the use of natural gas as a coolant, and control instrumentation will take up the morning meeting while the afternoon session will be devoted principally to consideration of automatic compressor stations, gas dehydration, and gas sweetening.

Pankow Heads LP-Gas Promotion Committee

A new promotional committee for National LP-Gas promotion meeting in Chicago last month elected John C. Pankow, Detroit Michigan Stove Co., as its chairman. Directed chiefly at the home market beyond the city gas mains, the promotion will be cosponsored by the Liquefied Petroleum Gas Assn., the Natural Gasoline Assn. of America, and GAMA.

Other prominent gasmen who are serving on the committee include Howard E. Felt, Warren Petroleum Corp., Tulsa; Lyle Harvey, The Bryant Heater Division, Cleveland; John K. Knighton, Servel, Evansville, Ind.; and A. V. Cameron, Ruud, Pittsburgh.

NORMAC
COUPLINGS, SLEEVES and FITTINGS

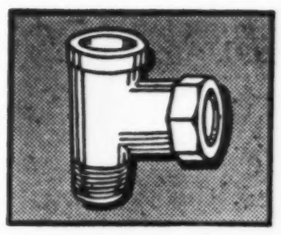


for maximum deflection, ease of "stabbing," complete confinement of the rubber!

So close are "Normac" rubbers confined at the gasket tip that possibility of flow is reduced almost to "nil." These couplings, sleeves and fittings . . . approved by gas utility men across the country for their time-saving features, ease of handling and dependable service . . . are available in a complete range of sizes. Made from air furnace malleable iron they provide greater wall thickness than pipe on which used.

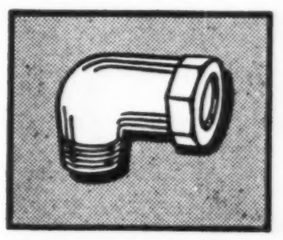
NORMAC COUPLINGS are made with 5" centers in all sizes. NORMAC SLEEVES are identical in design except that they are made with 10" centers. Nuts and gaskets are interchangeable.

COMPRESSION-END SERVICE "TEE"



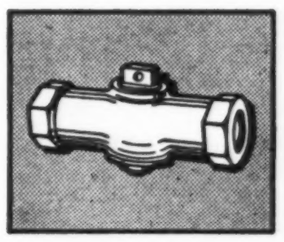
First fitting of this type ever produced with full coupling depth and special threads on male end to prevent dropping into old hand taps when used to replace standard threaded fittings.

COMPRESSION-END SERVICE "ELL"



Extra depth makes it possible to "stab" pipe into stops and without measuring, pull back a safe distance to allow ultimate deflection eliminating possibility of strain against tap in main.

COMPRESSION-END IRON BODY BRASS CORE SERVICE STOPCOCKS



End the necessity of threading on the job plus the elimination of the threads themselves — combining all the advantages of NORMAC COUPLINGS and the best in stopcock design. 2½" coupling depth on each end.

NORMAC BRASS FITTINGS DEVELOPED IN 1939 FOR USE WITH COPPER TUBING

Our complete line of brass fittings can be used either on new installations or where copper is run through old steel pipe in large or small openings. The center to end dimensions of NORMAC TEES correspond with old malleable iron fittings. This feature is extremely important in the use of these fittings in one foot openings where the tubing must line up with the steel which has been removed.

Write for the NORMAC CATALOG of Gas Distribution Equipment

NORTON-McMURRAY MFG. CO.

39 SOUTH LA SALLE ST. • CHICAGO 3, ILLINOIS

Couplings • Meter Bars • Sleeves • Cocks • Bell Joint Clamps • Service Tees & Ells

REGULATION

New York Utilities Tabbed Natural Gas Companies

Reversing an earlier initial decision by its presiding examiner, the FPC has declared Consolidated Edison Co. of New York Inc., Brooklyn Union Gas Co., and Kings County Lighting Co. natural gas companies and therefore under its jurisdiction. The question arose some months ago when the three companies filed applications requesting that they be found exempt from the Natural Gas Act or that construction and operation of 38 miles of pipeline be authorized.

The line will be used to transport natural gas from the Transcontinental Gas Pipe Line Corp.'s Texas-to-New York line entirely within the state of New York. The companies' contention that the facilities will be used only for local distribution was rejected by the commission, which said that the proposed transportation of gas originating in Texas and Louisiana through Transcontinental's lines and the integrated pipeline system of the New York companies to local delivery points "presents a complete and integrated operation having all the essential elements of interstate commerce."

A vigorous dissent from the majority finding was filed by Commissioner Claude L. Draper, who declared that there was no interstate element involved. "These New York companies," he declared, "are solely engaged in the local distribution of gas . . . To push a theory of jurisdiction to the lengths of this decision is, in my opinion, to exceed the bounds of jurisdiction prescribed by the Natural Gas Act and to attempt to reach into the heart of the local distribution problem."

Under the plan, ConEd will consruct about 23 miles of line at a cost of $9.3 million, Brooklyn Union will build 12 miles at a cost of $2.9 million, and Kings County Lighting will build 2.9 miles of line at a cost of $500,000. The combined facilities will be used jointly for the benefit of all three companies, as well as carrying gas to Long Island Lighting Co. and Brooklyn Borough Gas Co.

ConEd will receive 100 MMcf; Brooklyn Union, 60 MMcf; Kings County, 7.5 MMcf; Long Island Lighting, 20 MMcf; and Brooklyn Borough, 7 MMcf.

Bill Would Extend FPC Jurisdiction To Securities

Late in October Sen. Lyndon B. Johnson (D.-Texas), one of the leaders in the fight to have the Natural Gas Act amended, introduced a bill which would extend FPC's jurisdiction to include the issuance of natural gas securities.

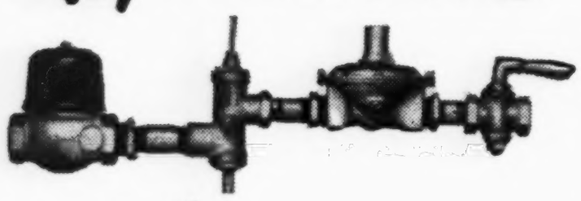
Under the measure not only would the FPC be given authority to impose or alter conditions for the issuance of securities of this type, but the commission would have exclusive jurisdiction over such matters. This is apparenly in conflict with the Holding Company Act, which gives that right to the SEC.

Submitted too late for consideration at the recent session, the bill is expected to be brought up during the forthcoming one. Excerpts from the bill follow:

"No natural gas company shall issue any security or assume any obligation or liability . . . and no person in a natural gas company shall issue any security . . . to . . . defray . . . the cost of construction, acquisition, or operation of any facility for which a certificate of public convenience and necessity is required unless and until . . . the commission . . . authorizes (it). The commission shall make such order only if it finds that such issue . . . is for some lawful object . . . compatible with the public interest . . . necessary . . . for the proper performance . . . of service as a natural gas company and which will not impair its ability to perform that service . . . The commission . . . shall make such supplemental orders . . . as it may find necessary or appropriate and may . . . modify the provisions of any previous order . . . The commission shall not authorize the capitalization of the right to be a corporation or of any franchise, permit, or contract for consolidation, merger, or lease in excess of the amount . . . actually paid as the considera-

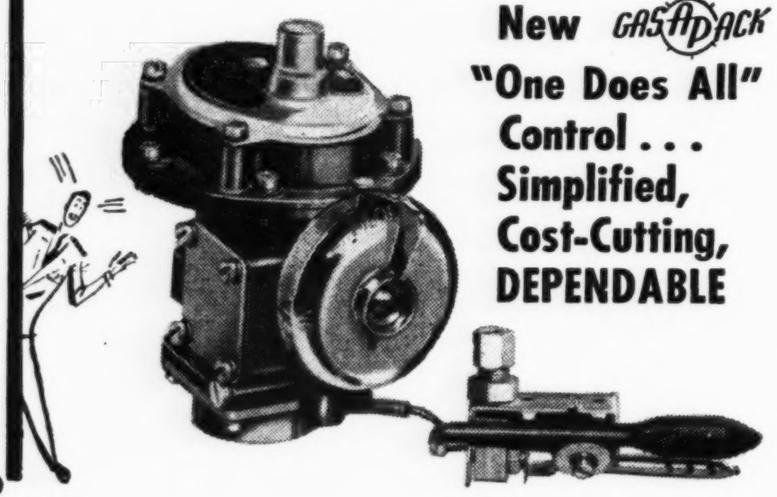
Want to Cut Gas Heater Costs and BOOST SALES...

Replace This



Present Multiple Assembly of up to Five Separate Gas Control Units

With THIS



New GASAPACK "One Does All" Control . . . Simplified, Cost-Cutting, DEPENDABLE

New GASAPACK Revolutionizes Gas Control in Circulating Heaters!

Actually, the new A-P GASAPACK eliminates all piping in your heater! Even the burner spud is an integral part. You tighten only 2 screws on a bracket to mount the GASAPACK. Then it's ready to connect to gas main. Every other control function is built in — pressure regulator, solenoid, filter, A-cock, B-cock. Takes less room than ONE of these separate units — only 5½" x 5½" x 3⅞".

New GASAPACK Model 54 "One Does All" Gas Control Features:

- 100% FAIL SAFE OPERATION
- 100% SAFE LIGHTING
- 100% SHUT OFF SAFETY
- 100% AUTOMATIC CONVENIENCE
- Only ONE Unit to Buy, Stock, Install
- Cuts Factory Assembly Time
- Simplifies Field Installation
- Saves Gas Control Costs
- Operates Quietly
- Helps You to Better Styling
- Provides Proven DEPENDABILITY
- A. G. A. Approved
- Capacity
  70,000 B.T.U. on gases less than 800 B.T.U. per cu. ft.
  100,000 B.T.U. on gases more than 800 B.T.U. per cu. ft.

GASAPACK AUTOMATIC TEMPERATURE CONTROL

Thermostatic Control "kit," easy to add in the field, includes: Automatic Electric Top, Low Voltage Thermostat, Transformer and all fittings. Provides the last word in heating convenience with your heater.

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Millions Know the Satisfaction of
DEPENDABLE Controls
FOR HEATING . . . AIR CONDITIONING . . . REFRIGERATION

tion for such right . . . (This) shall not apply to the issue or removal of . . . a note or draft maturing in more than one year after the date of such issue . . . and aggregating not more than 5 per centum of the book value of the other securities of the natural gas company . . . It shall be unlawful for any officer or director of any natural gas company or any other company whose security issues must be appproved by the commission under this section to receive . . . any money or thing of value in respect to the negotiation . . . or to share in any of the proceeds thereof."

Gas Bill Proration Wins In Bronx Court Test

Proration of gas bills as a substitute for metering won approval recently when the appellate division of New York's state supreme court unanimously reversed a Bronx municipal court ruling declaring the procedure invalid. The decision affects 1.8 million consumers.

The court held that the lower court was without jurisdiction as the public service commission, which had given its approval to the method, has authority over such matters.

1947 FPC Reports Available

Volume 6 of the FPC reports containing commission opinions and decisions for the calendar year 1947 came off the press last month. The 1200-page volume, priced at $3.25 per copy, includes formal opinions, intermediate decisions which have since become final, and an appendix of selected orders in the nature of opinions.

All reports from January 1931 are now available through the commission's publication section in Washington.

Wallgren Takes FPC Oath

Mon C. Wallgren, 58, whose appointment to the Federal Power Commission was approved in October, took oath of office Nov. 2 for a term expiring June 22, 1954.

Mr. Wallgren was formerly governor of the state of Washington, prior to which he served as senator and representative from that state. He succeeds Leland Olds.

FINANCIAL

Philadelphia Co.'s Annual Report Tops Utilities

The Philadelphia Co., Pittsburgh, placed at the top of the utility list in the matter of annual reports for 1948, and was awarded an "Oscar of Industry" late in October, at the fifth annual awards banquet of *Financial World* magazine. Columbia Gas System (New York) won the utility division of the contest to determine the best annual report advertisement.

Following the Philadelphia Co. in the utilities' annual report competition were Peoples Gas Light & Coke Co. (Chicago) and Citizens Utilities Co. (Greenwich, Conn.). Second and third places in the annual report advertisement contest were Pacific Gas & Electric Co. (San Francisco) and Southern Natural Gas Co. (Birmingham, Ala.).

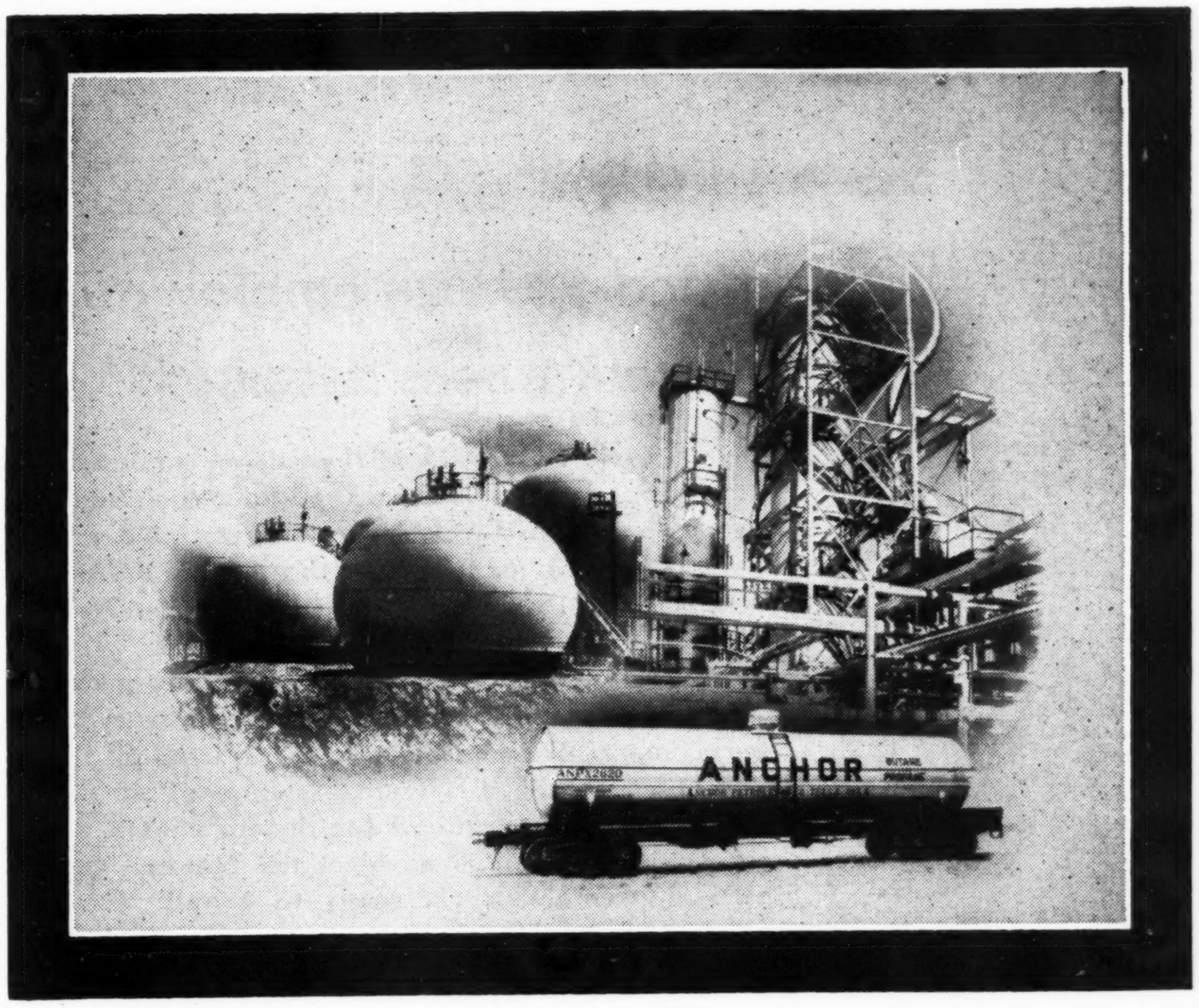
Financial World's awards banquet was held in the Hotel Statler, New York, on Oct. 31. The Oscar of All Industry—highest award presented—went to Standard Oil Co. of New Jersey.

SoCounties Asks Emergency Rate Relief

Emergency rate relief was asked by the Southern Counties Gas Co., Los Angeles, last month in a petition to the state public utilities commission. Specifically, extension and revision of the automatic "rate adjustment plan," which had been in operation since 1946, was proposed by the company.

Southern Counties announced that it now has an application for revision of rates on a permanent basis but that immediate emergency relief is necessary because of rising costs. Under the rate adjustment plan, discounts are applied to gas rates on the basis of a quarterly review of each preceding 12 months operation with no limit placed upon possible rate reductions but an upper limit holdings increases.

The other Los Angeles utility, Southern California Gas Co., already has a rate increase request before the commission.



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From our strategically-located plants we are able to give quick delivery on high-quality ANCHORGAS, Butane-Propane. Shipments by rail, water, or transport. For dependable gas service, call us before you renew your contract. Ask about Anchor's special contract.

ANCHOR PETROLEUM COMPANY

Atlas Life Bldg. Tulsa, Oklahoma

FPC Suspends Hope's Tariff Pending Further Hearings

Hope Natural Gas Co.'s proposed tariff changes, which would increase its wholesale rates by approximately $2 million annually, were suspended pending hearing and decision by the FPC last month. A subsequent order will set a new time and place for reopening the hearing.

Under the proposed changes in the company's tariff, rate increases would affect Hope's wholesale purchasers who serve principally Akron, Cleveland, and Canton, Ohio; Pittsburgh; and Syracuse, Rochester, and Buffalo, N.Y. The purchasers are East Ohio Gas Co., Peoples Natural Gas Co., New York State Natural Gas Corp., Manufacturers Light & Heat Co., and Mount Morris (Pa.) Gas Co.

The commission commented that a number of "interested parties" had questioned the methods and bases utilized by Hope in a cost study submitted in connection with the proposal.

Revenues Continue Gain But Incomes on Downgrade

Operating revenues of natural gas companies continued to gain in August, but operating income and net income conversely were down from a year ago, according to the FPC. Total revenues of $62.8 million represented an increase of 9.5% over the $57.4 million reported for August 1948.

Operating income dropped 5.6% from $6.4 million to $6 million. Net income was down from $6.1 million to $5.97 million. Sales to ultimate consumers were up 1.6% despite a drop of 3% in sales to residential consumers.

For the 12 months ended Aug. 31, operating revenues totalled $952 million, up 15.3% over the previous $826 million.

Washington Wins Rate Boost

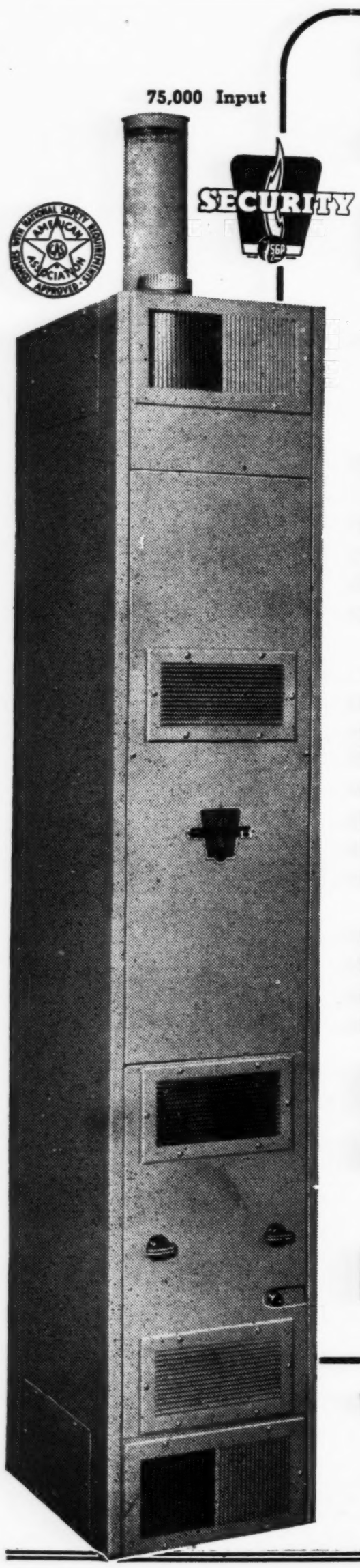
After a long and bitter fight Washington (D..C.) Gas Light Co. last month won public utilities commission approval of a 6.14% gas rate increase to District of Columbia subscribers. The company had sought an increase of approximately 7% which would have brought some $150,000 more than the estimated $750,000 added revenue made possible by the commission's decision.

Largest percentage of increase under the new schedule will fall on the householder who does not heat his house with gas. An increase of 8.01% has been imposed on this class of consumer. Apartment sales and government sales bore the least increases.

The company's request for an increase had met strong opposition, particularly from dealers who objected to the company's merchandising policy on gas appliances and to the method by which such sales entered into the rate picture.

Financial Footnotes

Unit shipments of gas conversion burners are continuing their upward trend. GAMA reports that 18 notifying companies increased shipments by five times in the first eight months of this year, over a like period in 1948. Similarly, shipments of gas-fired boilers, furnaces, floor furnaces, and domestic gas ranges all had a good month last August. Shipments of gas-fired water heaters in August dipped sharply (by 15.3%) under the total for the same month last year . . . An annual saving of $10 to $12 for Detroit domestic space heating customers is expected to result from the completion of the 1609-mile pipeline from Texas. The line was completed in mid-October . . . Union Gas Co. of Canada Ltd. (Chatham, Ont.) has announced a rate increase of 3 cents per Mcf above 2 Mcf. Union Gas made its announcement to include Windsor Gas Co. Ltd. (Windsor, Ont.), and the City Gas Co. of London. Devaluation of the pound was named as the cause for the increase, since it raised prices for refinery still gas . . . Texas Eastern Transmission Corp. earned $1,769,700, or 38.5 cents per share, in the third quarter of 1949, according to quarterly statement to stockholders . . . Affiliated Gas Equipment Inc. net income for the third quarter zoomed a stunning 151% over the previous quarter, the company has announced. Affiliated acquired Bryant Heater Co., Day & Night Manufacturing Co., and Payne Furnace Co. last January . . . Cuts up to 20% in the gas bills of Milwaukee customers have been promised by Glenn R. Chamberlain, president of Milwaukee Gas Light Co., to go into effect when the city is fully supplied by natural gas.



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...and you can employ duct work where necessary!

YES, sir . . . here is *the* answer to heating properly small homes without basements. Security's INN-A-WALL is an entirely new principle in forced air heating! Requires minimum duct work . . . may be used without ducts. Needs only 16 by 20-inch floor area.

The INN-A-WALL reverses the usual flow pattern . . . warm air comes out the *bottom*. This means *warm floors!* Warm air can be taken from all four sides . . . return air, from all sides at the top. Where ducts are required for distant rooms, permanent connection is made at the bottom. Completely assembled . . . ready to install. Casing height, 88 inches. Security breather tube automatically supplies air for combustion.

Other outstanding INN-A-WALL values are • Quiet positive blower • Fully automatic • Special Security high-efficiency burners • Complete adaptability to any floor plan • Amazingly economical in price.

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EXPANSION

Niagara Companies Contract For Natural Gas

Two of the principal operating companies of the Niagara Hudson Power Corp. have filed 20-year contracts with the New York State Natural Gas Corp., Pittsburgh, which will assure them of gas to serve an area of New York state extending from Albany west to Utica and from Hudson north to Glens Falls. This is the first step in a plan to convert service throughout the system's eastern area to natural gas.

Earl J. Machold, company president, stated that applications for approval of the project would be filed shortly with the state public service commission and the FPC. The company now supplies manufactured gas to 145,000 customers in the cities of Albany, Schenectady, Amsterdam, Troy, Saratoga Springs, and Glens Falls.

Central New York Power Corp. has contracted for all the natural gas required for its customers in the Utica division where manufactured gas has been distributed to 57,000 customers. Central New York has for the past 18 years supplied natural gas to 78,000 customers in the Syracuse-Oswego division.

New York State Natural expects to secure part of its requirements from Tennessee Gas Transmission Co.'s line which will be constructed from Buffalo to Boston if the FPC gives its permission.

Construction Progressing In Long Island System

Although current construction projects will not be completed in time to affect this winter's output, Long Island (New York) Lighting Co. expects the supply situation to be the best since the 1945-46 season.

New construction in the planning stages or under way includes a 5 MMcf holder at Glenwood, which may be ready early in 1950, and a catalytic cracking plant at Glenwood Landing, for which construction contracts have been signed. The catalytic plant will be similar to the one now in operation at Riverhead and will be used to handle the natural gas scheduled to reach New York late in 1950.

Long Island's system will benefit from the Texas gas to be brought through the Transcontinental Gas Pipe Line Corp. line now being built.

Footnotes on Expansion

Another utility was added to the growing list of gas companies now serving gas for heating purposes when the New York public service commission last month authorized Central New York Power Corp. to lift bans on new customers in the Syracuse area . . . Iroquois Gas Corp., Buffalo, has been authorized by the New York public service commission to absorb the Wanakah Gas Corp. on the eastern shore of Lake Erie and the gas plant located in North Collins . . . Arkansas Power & Light Co. has requested permission of the Arkansas public service commission for the construction of a gas distribution system in Nettleton (Craighead county), Ark. . . . Rochester Gas & Electric Corp. has begun construction of third section of its 12-in. line to provide more natural gas for Rochester consumers in the East River Rd. area. Project will cost $650,000 . . . Gas was turned into the Goldthwaite, Texas, distribution system in October as the first of 10 towns in Texas' hill country was connected to the new Lone Star transmission system . . . FPC Examiner Edward P. Marsh ordered Panhandle Eastern Pipe Line Co. to deliver natural gas to the City of Indianapolis, Ind. in an initial decision last month . . . E. H. Sargent & Co., maker of scientific laboratory instruments, apparatus, and chemicals, has moved into its new, modern building which now houses its Chicago offices and plant. The address is 4647 W. Foster Ave. . . . Architects' drawings have been completed for additions to the 4th and Main street building of Cincinnati Gas & Electric Co. This building will be in addition to a new service building for the gas department which is nearing completion . . . Natural gas, which recently came to New York & Richmond Gas Co., Staten Island, N. Y., was turned into the lines of customers Nov. 1. New lower rates went into effect as a result of the changeover. Total savings to consumers are estimated at $232,000 a year . . . With the installation of gas service facilities in the Milwaukee area nearing completion, building of lines at Manitowoc, 90 miles north, has been started.

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CHART
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10 ROTATION SPEEDS
Converter gears requiring no tools to install, changes the clock from 24 hour rotation to any one of 10 different chart rotation speeds. Adapters are available to fit the Arcco Macnick Chart Clock to practically every make of recording guage.
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The clock has been engineered to insure accurate operation under all field conditions. The case, made in two parts, is joined and hermetically sealed by a tightly fitting neoprene gasket of special design which protects against moisture, dust or corrosive gases. Price $10.50 fob Los Angeles or Tulsa.
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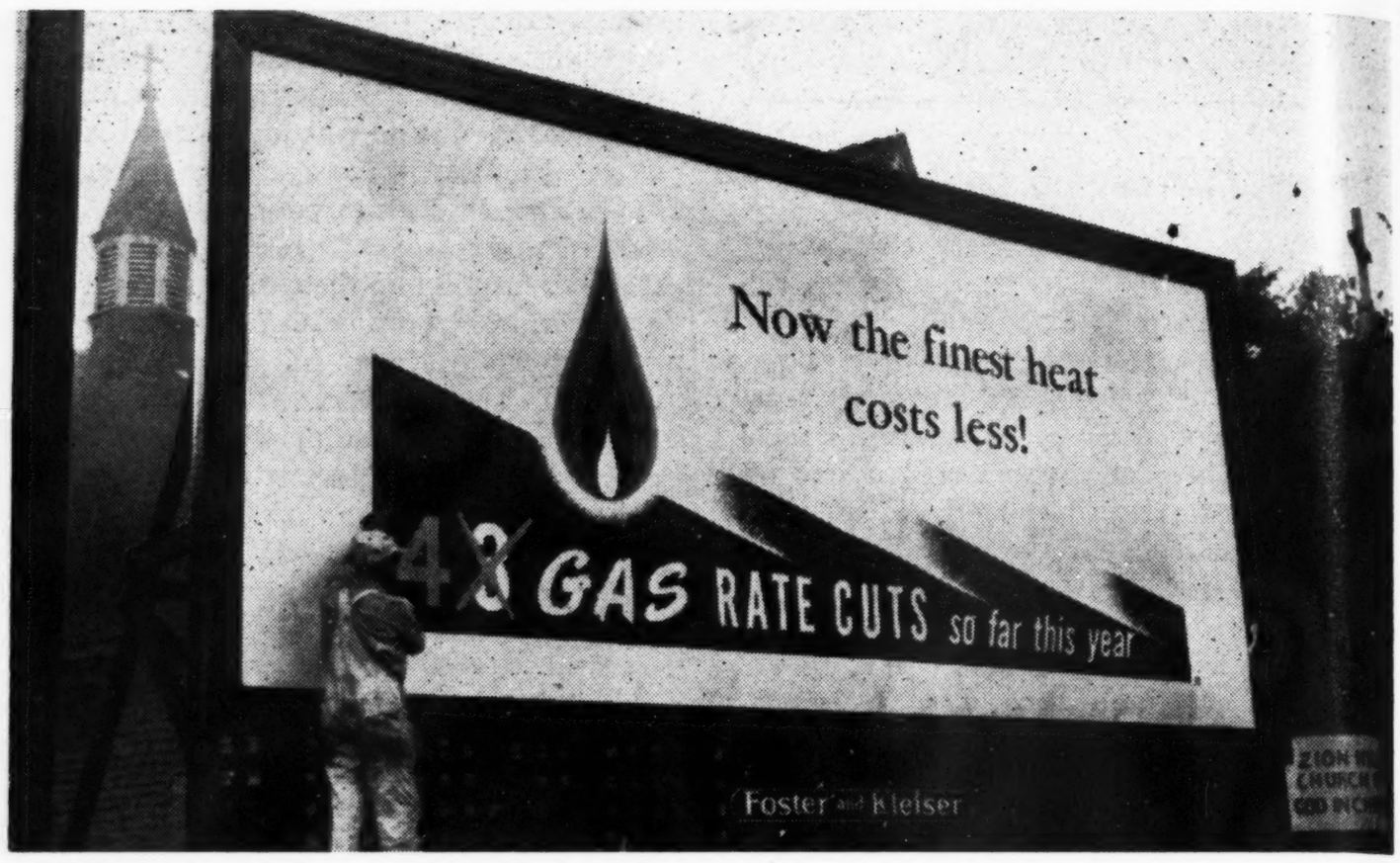
MISCELLANY

Heavy Storage Brightens Pittsburgh Storage Picture

Pittsburgh appears to be in good shape for the approaching peak-load periods with substantial stores of gas on hand, the three companies serving the area have announced.

Equitable Gas Co. has more than 15 billion cu ft in underground storage, Peoples Natural Gas Co. has stored more than 10.5 billion cu ft, and The Manufacturers Light & Heat Co. has more natural gas in underground storage reservoirs than ever before.

Ninety-five per cent of all new one- and two-family dwelling units in Equitable's territory are now using natural gas for house heating. Peoples, which serves customers throughout western Pennsylvania, has reportedly approved approximately 17,000 applications for gas heat since priority restrictions were lifted for many areas last Feb. 15.



With this year's four rate reductions rolling back the cost of cooking and water heating to practically pre-war levels, and also making substantial reductions in the cost of gas heating, Portland Gas & Coke Co. at times has had to have Foster & Kleiser do "patching" like this to keep billboards up to date.

Dual-Fuel Engine Savings Lead to Repeat Sale

A fuel saving of $10,000 over a six-month period effected through the use of a 1440-hp dual fuel engine has prompted the Board of Public Works, Auburn, Neb., to buy a second engine of this type for use in its municipal power plant.

The new engine, which replaces an older 300-hp unit in the power station, was manufactured by Superior Engine Division of the National Supply Co. The first engine was shipped to Auburn in 1947.

ConEd's School for Drivers

Safety-minded Consolidated Edison Co. of New York has set up a new school for company drivers. Consisting of a two-day course of classroom instruction and field trials, the school is being held for chauffeurs, truck chauffeurs, and operators.

Coincidentally, the company has issued a new booklet for its 4000 system drivers titled "Manual for Con Edison Drivers." Defensive driving is stressed in both activities.

Atomic Competition Discounted

The high cost of atomic power plants makes it unlikely that nuclear power will make any large-scale inroads into the industrial power production picture, Ward F. Davidson, research engineer for Consolidated Edison Co. of New York Inc., told his audience at the 12th annual joint fuel conference in French Lick, Ind., in late October. Mr. Davidson predicted that nuclear power plants might supplement rather than substitute for power from today's sources.

Miscellaneous

Winner in the National Fleet Safety Contest for Public Utilities, Group 1, sponsored by the National Safety Council, is the Community Public Service Co., Fort Worth. The company's 208 vehicles scored 12 accidents in 2,238,931 miles, or .5 accidents per 100,000 miles. Presentation was made at the National Safety Congress, Oct. 27, at the Palmer House, Chicago . . . A free course, consisting of one class a week for six weeks, is under way for dealers and installers of gas heating equipment in the Milwaukee area. Milwaukee Gas Light is conducting the courses coincidentally with the change-over to natural gas. Attendance of at least one employee of a firm is required for qualification as a registered dealer . . . The American Standards Assn. Inc. has announced that new requirements for domestic gas ranges, water heaters, room heaters, incinerators, hot plates and laundry stoves, gas hose for portable appliances, and gas valves are now being printed and will soon be available to interested parties . . . Clark Bros. Co. Inc. last month moved its Los Angeles office to new headquarters at 5706 Bickett St., Huntington Park, California.

PEOPLE

F. O. Ward **C. O. Pandorf**
. . . Stacey Mfg. Co.

FREDERICK O. WARD and CHARLES O. PANDORF have been appointed assistants to the vice president of The Stacey Manufacturing Co., Cincinnati, and have been assigned to the sales department. Mr. Ward served in the Navy during the war and then spent several years in Stacey's production and other departments. Mr. Pandorf has had experience in the company's engineering department.

MILTON H. ROTHS has been appointed by Joseph A. Coy Co. Inc., Tulsa, as its Houston representative. He will maintain the company's office at 4101 San Jacinto. Mr. Roths will expand Coy's sales engineering service for heat exchangers in the area.

WILLIAM HILE, a member of the application engineering department of Taylor Instrument Co.'s, Rochester, N. Y., for several years, has been placed on the firm's industrial sales staff and his territory is the state of Indiana. DAMON C. RALPH, DONALD F. SULLINS, and CHARLES H. MILLER are other new salesmen and are working, respectively, in Freeport, La., northwest Texas, and Omaha.

J. J. KNOTEK, who has had 22 years of merchandising experience with Magic Chef in New York, is now manager of American Stove Co.'s Pacific sales division, replacing R. W. CAMPBELL, who resigned. Mr. Knotek is located in Los Angeles and covers California, Washington, Oregon, Arizona and Nevada.

FRANCIS W. McMENIMEN, secretary of Public Service Electric & Gas Co.'s (Newark) suggestion plan committee since 1939, recently was elected president of the National Assn. of Suggestion Systems at the organization's fall conference in Cleveland.

FRANK B. FRY has been named superintendent of the gas street department, Public Service Co. of Colorado, Denver, succeeding the late C. A. Johnson. Mr. Fry has been associated with the company since 1936.

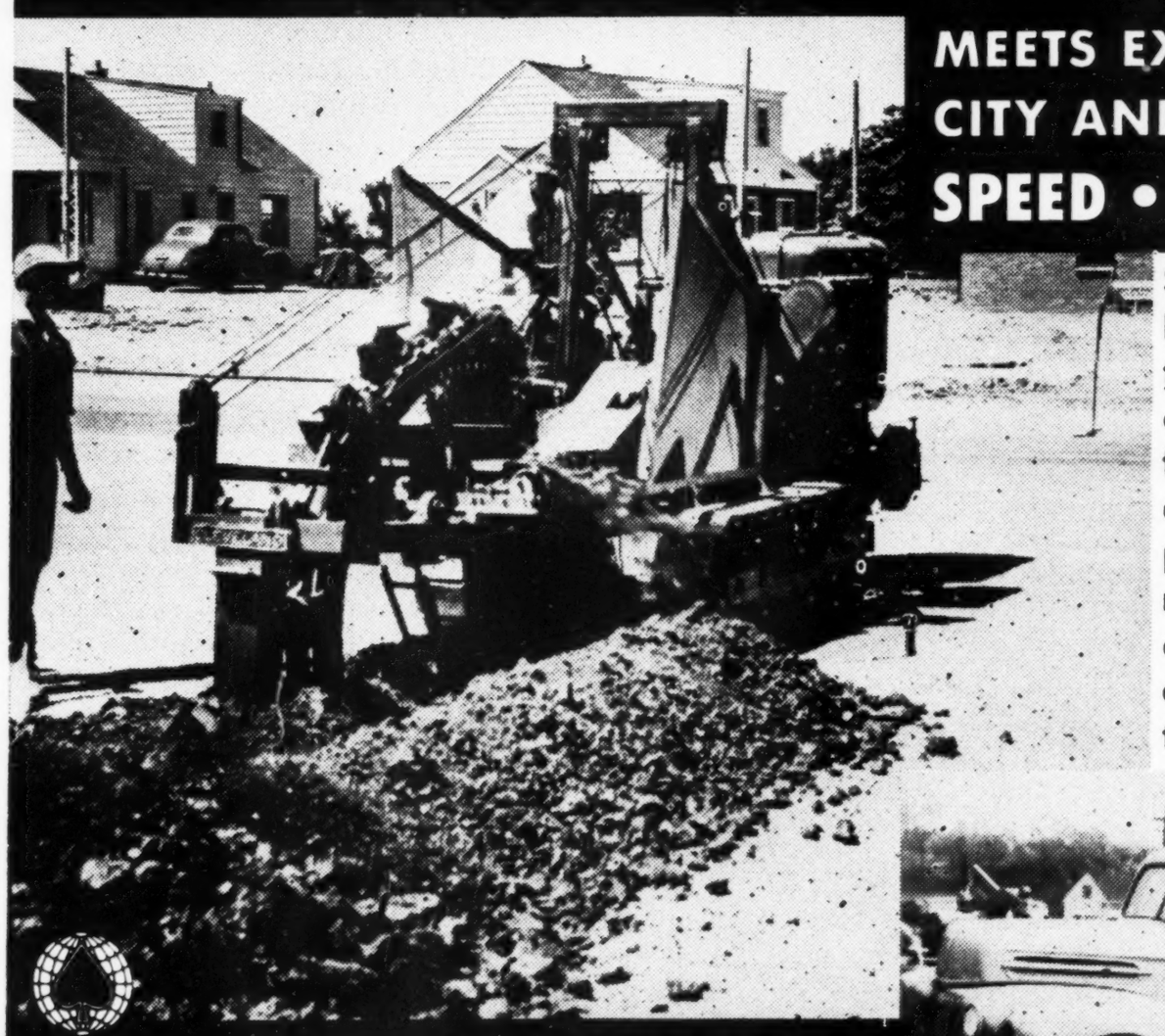
J. G. Berwanger **R. S. Wenner**
. . . Ohio Fuel Gas

JOSEPH G. BERGWANGER has been appointed manager of The Ohio Fuel Gas Co.'s (Columbus) enlarged dealer promotion program, with eight dealer promotion representatives working under his direction. RALPH S. WENNER, who has been associated with the company since 1929, has been promoted to industrial and commercial sales manager and has moved to the Columbus general offices. Mr. Wenner succeeds F. T. RAINEY, who resigned.

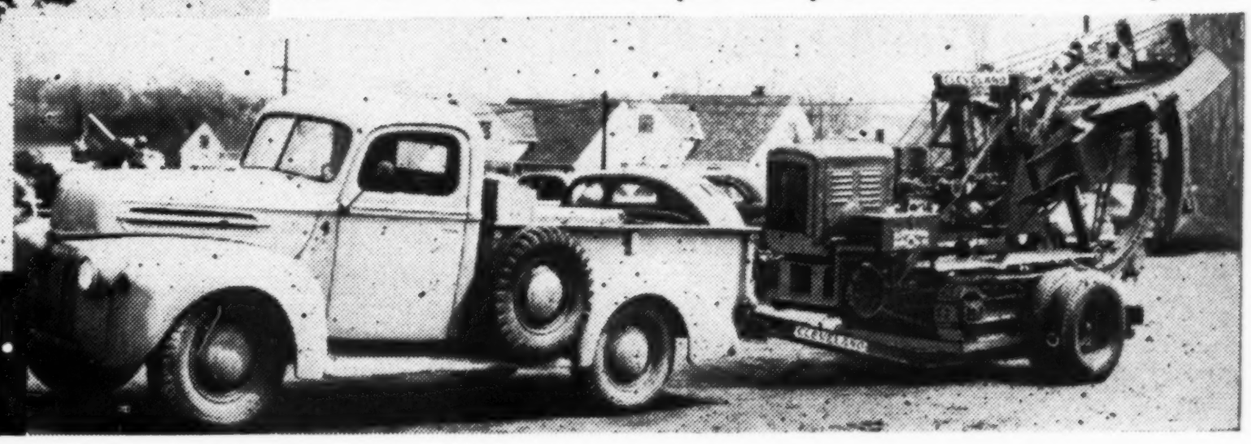
M. W. ARTHUR, vice president and general manager, and H. B. HARDWICK, comptroller, have been elected to the board of directors of Consumers Power Co., Jackson, Mich. Both men have been associated with Consumers and affiliated companies since 1918. They succeed two directors who have retired, JAMES A. BROWN and WALTER D. KLINE.

ON YOUR GAS TRENCHING PROJECTS
THE CLEVELAND BABY DIGGER *Model 92*

MEETS EXACTLY YOUR REQUIREMENTS FOR CITY AND SUBURBAN WORK—
SPEED • MANEUVERABILITY • MOBILITY



Small, rugged, fast and exceptionally compact, The New BABY DIGGER MODEL 92 cuts a full 5 feet deep and 10" to 20" wide. A multiplicity of crawler and wheel speeds and their combinations positively assures the best and fastest speed for the work at hand. Traveling on specially designed smooth-surfaced crawlers, the "92" has that perfect balance, sure-footed traction and hair-line maneuverability so essential to operating in cramped areas. Easily, quickly and safely loaded and unloaded on its rubber-tired tilt-body electric-braked trailer, the "92" travels from job to job at fast truck speed.



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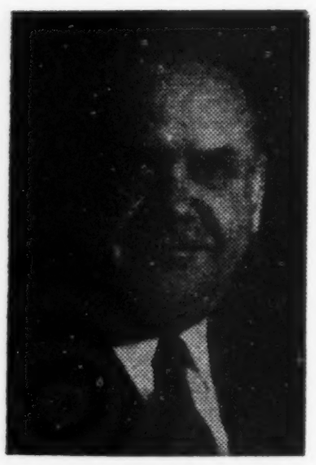


F. B. Dunn
. . . A. O. Smith

G. F. Bauer Jr.
. . . Roach

ELROY L. PAYNE, former president of the Payne Furnace Co., Beverly Hills, Calif., has joined Empire Stove Co., Belleville, Ill., as a regional manager for southern California. It was announced at the same time that the Beverly Heating Supply Co. in Beverly Hills has been appointed a distributor of Empire gas appliances.

FRANKLIN T. RAINEY, Ohio Fuel Gas Co. executive since 1928, has accepted a position as vice president in charge of pipeline operations for East Tennessee Natural Gas Co., Nashville, Tenn. During his long gas industry career, Mr. Rainey has been active in the American Gas Assn., and he is presently serving on five AGA committees.

R. J. DRIGGS has been appointed west coast representative for Dresser Manufacturing Division, Bradford, Pa. Mr. Driggs, who has conducted his own contracting business for several years, will cover the three Pacific coast states. He maintains a sales office in San Francisco.

VERNE H. SCHNEE, formerly assistant director of the Battelle Memorial Institute, has been named director of the University of Oklahoma Research Institute in Norman. Mr. Schnee is the first full-time chairman of the Oklahoma institute.

O. G. MANDT, who recently retired as president of Jaeger Machine Co., Columbus, Ohio, heads the Mandt Manufacturing Co., which was recently incorporated at Columbus. A plant at Warren, Ohio, is now in production on a hydraulically operated material loader which the company will distribute from coast to coast. Other officers of the new firm are V. G. MANDT, vice president in charge of sales; J. J. QUILLIGAN, secretary-treasurer; and CHARLES TAYLOR, assistant secretary-treasurer.

MISS C. LOUISE FRAZIER has joined the home service department of The Manufacturers Light & Heat Co., Pittsburgh, and will headquarter in the company's new home service center at Gettysburg, Pa. MISS RITA M. McINTYRE, newly appointed home economist for the company, will be located in the Washington office and will work in the Washington-Waynesburg area.

J. M. CLARKE JR. has joined the sales staff of Detroit-Michigan Stove Co. Mr. Clarke will work in the Carolinas and eastern Tennessee under the supervision of F. F. HAMILTON, southeastern division manager.

CHARLES E. HICKEY, manager of the outside plant construction department of Consolidated Edison Co. of New York Inc., retired recently after 41 years with the company and its subsidiaries.

FRANCIS B. DUNN recently was named manager of the Houston Works of A. O. Smith Corp., Milwaukee. C. W. WHEATLEY, who had been assigned temporarily to building up postwar management of the Houston Works, has returned to Milwaukee to resume work on the general staff.

GEORGE F. BAUER JR., who recently resigned from Sharples Chemicals Inc., Chicago, has joined the Roach Equipment Manufacturing Co. as national sales manager. He will establish dealers and sales representatives in major cities of the U. S. Mr. Bauer is also president of The Cherokee Co., Tulsa, sales distributor of gas odorants.

R. H. Tillman

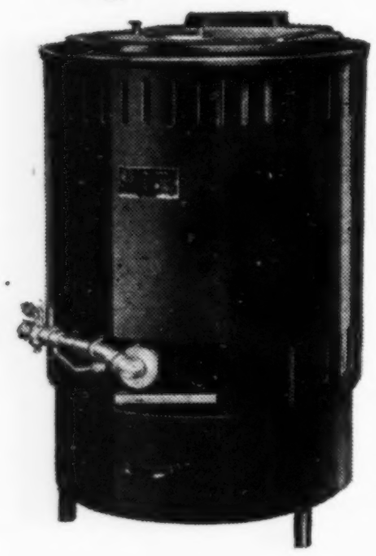
M. C. Albrittain
. . . Consolidated of Baltimore

R. H. TILLMAN, general manager of the industrial and commercial department of Consolidated Gas Electric Light & Power Co. of Baltimore, retired Nov. 1 after 40 years of service. He has been succeeded by MASON C. ALBRITTAIN, who joined the company 25 years ago and most recently served as assistant general manager, industrial and commercial department.

MAX K. WATSON, who has been connected with Canadian River Gas Co., Amarillo, Texas, for the past 20 years, has opened his own office as a gas consultant. Mr. Watson was assistant to the president of Canadian River at the time of his resignation. He is specializing in gas valuations, regulations, and proration.

ROLLAND J. HAMILTON, retired Nov. 1 from the vice presidency of American Radiator & Standard Sanitary Corp., Pittsburgh. He will continue to serve on the company's board of directors and executive committee. Mr. Hamilton has been in the employ of American-Standard and its predecessor, American Radiator, for almost 45 years and served in various executive capacities for most of that time.

Incinor
TRADE MARK
REG U S. PAT OFF



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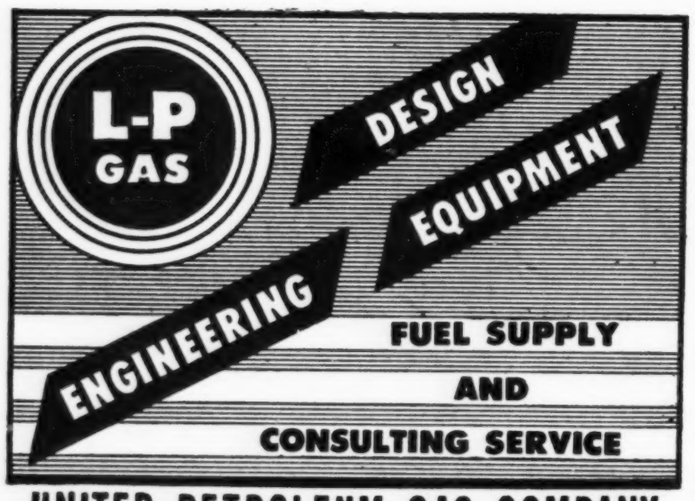

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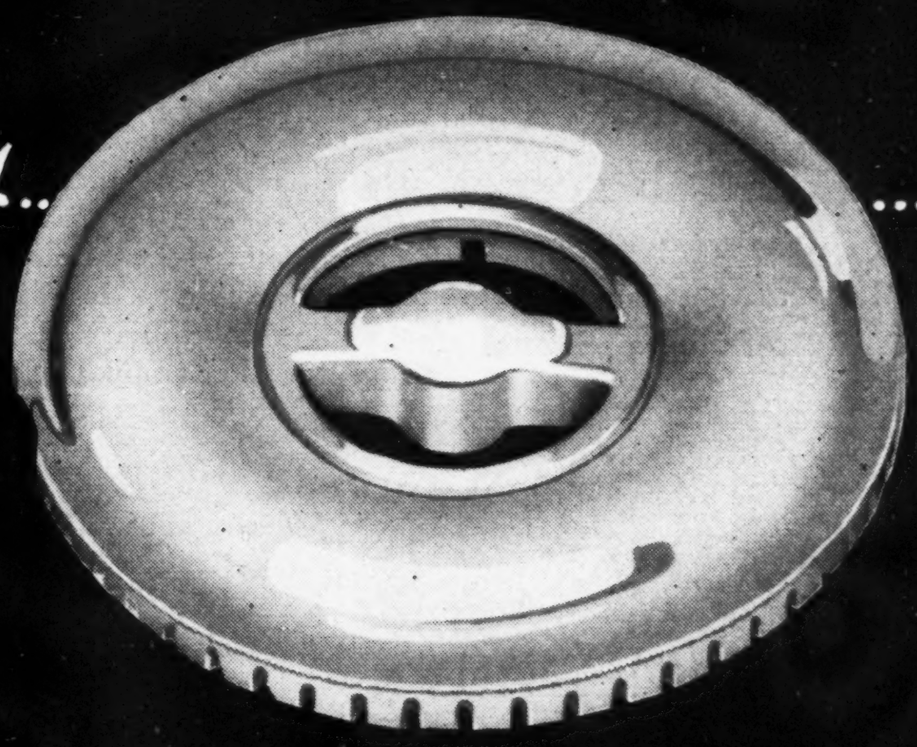
Detroit Brass Introduces...



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For All Appliance Gases

For greater efficiency, more attractive appearance and universal application, Detroit Brass introduces the "DB" Universal Burner Cap. The "DB" Burner Cap is designed to accommodate bottled (LPG), manufactured, natural and mixed gases. Thus it is universal. The new cap is available in both standard and giant burner sizes.

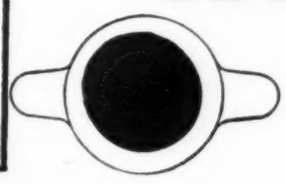
The good-looking "DB" Burner Cap is of smart design . . . it will add to the attractiveness of your appliance. It has a high polish finish. It is easy to keep clean—there are no sharp corners to collect soil.

A product of our research and experimental laboratories, the new universal cap is presented after extensive study and test with all types of gases and under varying conditions. We believe it will satisfy your most exacting requirements for burner caps.

The "DB" Universal Burner Cap is already in production and prompt deliveries are assured. We will be pleased to forward a sample for your inspection.

VALVES
THE HEART OF YOUR APPLIANCE

Be Sure They're The Best
Be Sure They're Detroit Brass



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DETROIT BRASS and MALLEABLE WORKS

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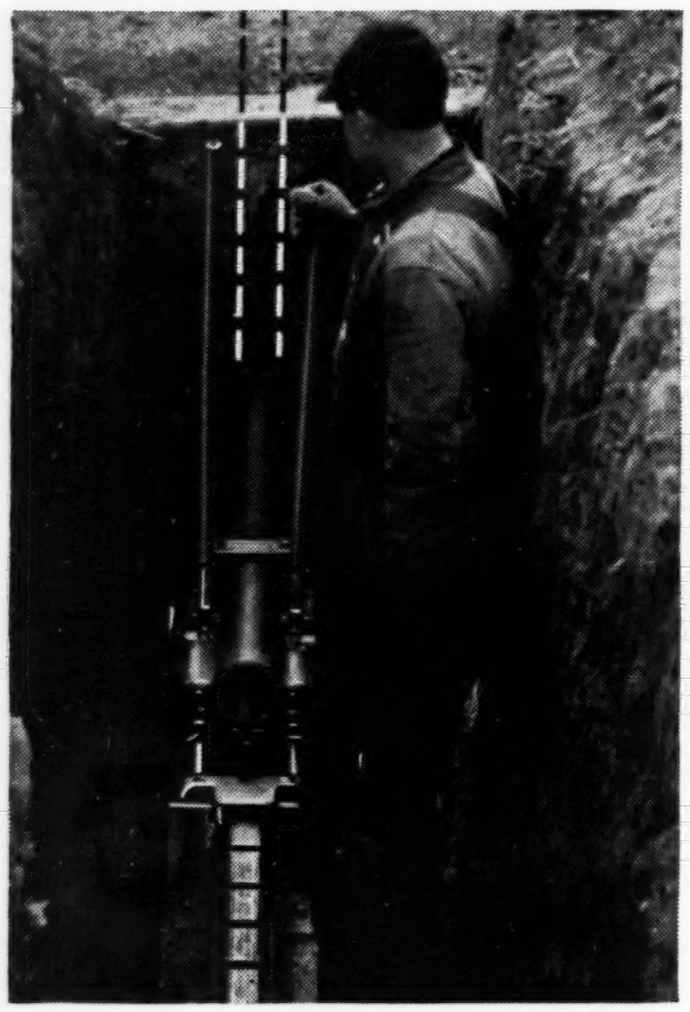
PUSH PIPE

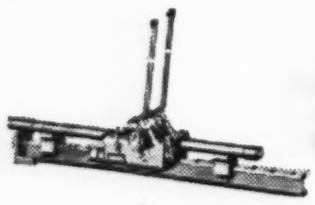
UNDER STREETS, WALKS,

TRACKS, FLOORS



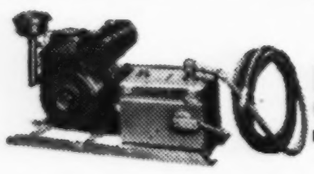
...with a GREENLEE PIPE PUSHER

Yes, here's the quick and simple way to install underground pipe. With a GREENLEE Hydraulic Pipe Pusher *one man* pushes pipe *under* obstacles. No tearing up of pavement, lawns, floors... eliminates extensive ditching as just a short trench accommodates the Pusher. No tedious tunneling, back-filling, tamping, or re-paving. Job time is cut to a fraction. Pusher often pays for itself through labor savings on the first job or two.



No. 790 GREENLEE PUSHER
For 3/4 to 4-inch pipe. Six Speeds—6,500 to 40,000 lbs. pushing pressure.

No. 795 GREENLEE PUSHER
For pipe larger than 4-inch, concrete sewer pipe, large drainage ducts. Six speeds—25,000 to 150,000 lbs. pushing pressure.



POWER PUMP for both sizes of GREENLEE Pushers. Pushes pipe at rate of two feet per minute.

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Get facts on timesaving Greenlee tools now. Write Greenlee Tool Co., Division of Greenlee Bros. & Co., 1952 Columbia Avenue, Rockford, Illinois, U. S. A.

JACK FATHERREE, GUY TRIBBLE and JOHN ANSELIN, all formerly traveling auditors for Lone Star Gas Co., Dallas, have been named division accountants under the general division of distribution. The new positions were created to provide division superintendents with the necessary assistance for maintaining closer control over office organizations and accounting procedures, according to L. L. Dyer, Lone Star comptroller. M. L. BIRD, superintendent of the company's Abilene division, has been appointed operating manager of the general division of distribution. JOE C. DARROW has moved to the Abilene post, and his position as superintendent of distribution for the Dallas division has been filled by L. D. BLACK, former manager of the Brownwood district.

P. A. Palmgren

R. R. Rosell Jr.

. . . General Controls

J. F. RAY, vice president in charge of sales for General Controls, Glendale, Calif., has announced the opening of new factory branch office facilities in three cities, bringing to 21 the number of factory branches. Named as managers in the new offices were R. ROGER ROSELL JR., Minneapolis; PAUL A. PALMGREN, Buffalo; and FRED H. ANGIER, Baltimore.

O. B. FANCHER recently was promoted to general foreman of the main and service department of Alabama Gas Corp., Birmingham, succeeding WILLIAM C. VOIGT, who retired. The company also announced the promotion of CHARLES D. DOWNING to manager of industrial sales. Mr. Downing has been associated with the firm since 1932 and Mr. Fancher since 1925.

GEORGE S. YOUNG, vice president and a director of the Columbia Gas System Inc., has been elected executive vice president. In 1930 Mr. Young joined Columbia Gas as an engineer. He became vice president of Columbia Engineering Corp., the system's service company, in 1942 and was elected a director in 1945.

GEORGE LUCKEY has been appointed assistant to the president of Public Service Co. of Northern Illinois, Chicago. Mr. Luckey, who has been associated with the company for more than 24 years, began as a stenographer and has served as secretary to the vice president in charge of operations and secretary to the president.

N. P. HEATH, executive vice president of Southwestern Gas & Electric Co., Shreveport, was elected president of the Louisiana Safety Assn., which held an organizational meeting in Shreveport recently. The new association also selected six other officers and 54 directors.

CARL L. BLAKE, who has been in the laboratory equipment division of Hamilton Manufacturing Co., Two Rivers, Wis., for the past nine years, has been named regional sales representative for Hamilton automatic clothes dryers. The firm also announced the appointment of MRS. HELEN TANGEN as director of home service for the dryer. Mrs. Tangen will make her headquarters at the home office in Two Rivers.

HUGH C. MINTON, vice president and head of the production department of Koppers Co. Inc., Pittsburgh, resigned recently because of ill health. Two administrative changes which resulted were the naming of FRED DENIG, former vice president and manager of the research department, as manager of the production department and his replacement by G. FRANK D'ALELIO.

CURTIS FISHER, vice president of Houston Natural Gas Corp., resigned recently. Mr. Fisher had been associated with the firm since 1926 and had been vice president since 1940. He went to Corpus Christi when the company established an executive office there in 1946 and has been active in company and civic affairs in that city for the past three years.

WILLIAM H. KILKENNY, materials handling engineer, is the new general manager of the Hyster Co.'s Huntington Park, Calif., retail store. Mr. Kilkenny has done sales administrative work for the company, whose headquarters are in Portland, Ore.

- OBITUARIES -

JOHN KEAN, president of Elizabethtown Consolidated Gas Co., Elizabeth, N. J., died recently at the age of 60. Mr. Kean also was president of the Elizabethtown Water Co. and the National State Bank, Elizabeth. He served in the army during World War I and joined the Elizabeth utility after being discharged.

GEORGE A. HILL JR., president of Houston Oil Co. and Houston Pipe Line Co. since 1932, died Nov. 2 in Greenville, S. C. The 57-year-old Houston oilman was vice president and director of Houston Natural Gas Corp. from 1928 to 1932.

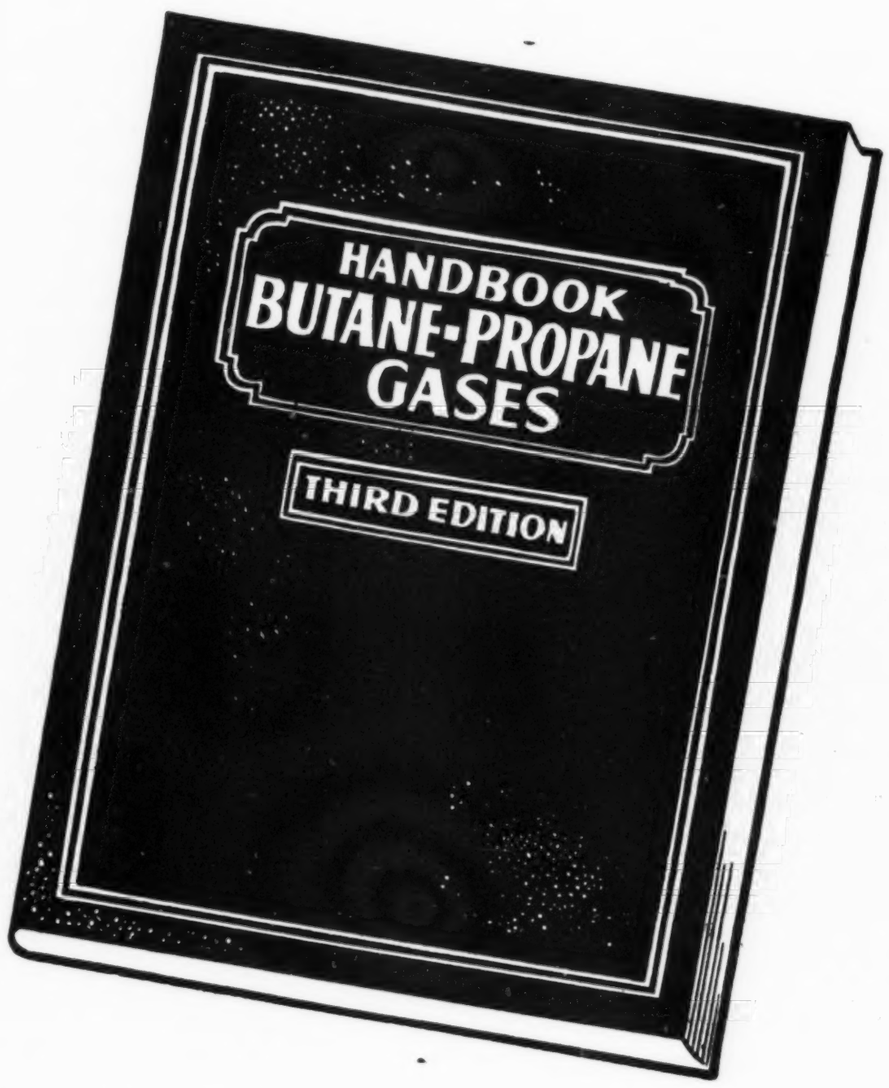
BRIAN R. MUIRHEAD, vice president and treasurer of Universal Oil Products Co., Chicago, died Oct. 20 on a train en route to Detroit. Mr. Muirhead formerly had been treasurer of the Arkansas Natural Gas Corp., Shreveport.

GEORGE L. HARRISON, 53, an assistant controller of Consolidated Edison Co. of New York Inc., died Nov. 2 after a prolonged illness. Mr. Harrison was first employed by ConEd in 1912.

FRANK W. SAUER, 66-year-old veteran employee of Seattle Gas Co., died Oct. 22. Mr. Sauer joined the utility in 1902 and was a distribution engineer at the time of his death.

JOHN A. HEANEY, 64, died recently of a heart attack. Mr. Heaney had been with the Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y., for 40 years.

AGAIN AVAILABLE!



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Comparative Performance with Other Fuels
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Domestic Applications
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Enrichment, Peak Load and Standby Uses
Fuel for Internal Combustion Engines
N.B.F.U. Pamphlet No. 58 (1947)
Motor Carrier Regulations
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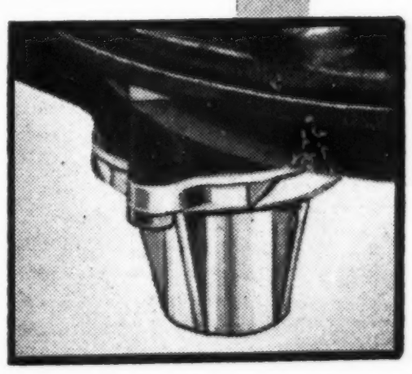
Whether your requirement is a matter of ounces or hundreds of pounds pressure — Reynolds will design, engineer and build the proper type and size regulator to meet your actual operating conditions. Reynolds regulators are proved by performance in factory supervised tests under actual operating conditions. Call on Reynolds to assist in solving your gas control problems.

REYNOLDS *NO-LOSS* MERCURY SEAL FOR ALL SERVICE REGULATORS

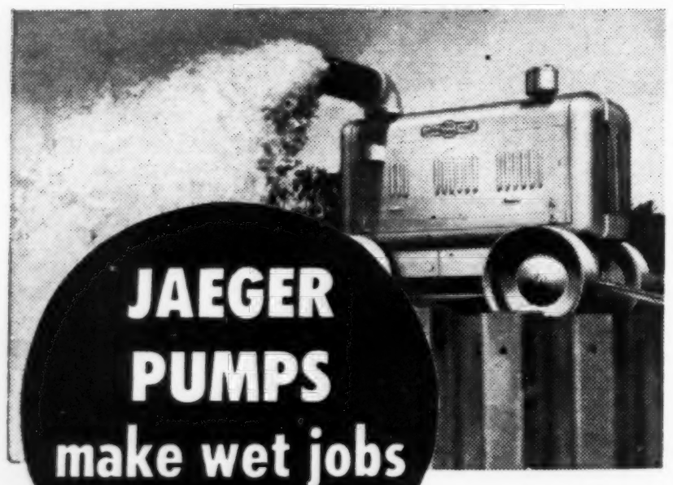
Reynolds new exclusive Mercury Cut Seal is held rigidly to the body by two screws. In case the seal blows, the patented design insures recovery of more than 95% of the mercury.



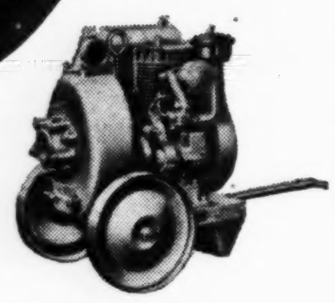
GAS CONTROL SINCE 1892

Reynolds
GAS REGULATOR CO.
ANDERSON · INDIANA · U. S. A.

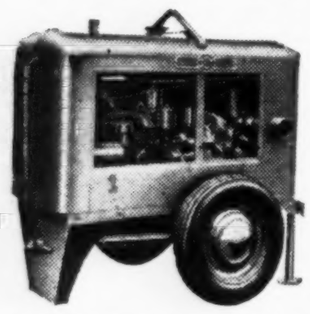
New 2" aluminum pump weighs 105 lbs., pumps 9000 gph . . . Gives high head performance for price of low head pump.



JAEGER PUMPS make wet jobs dry

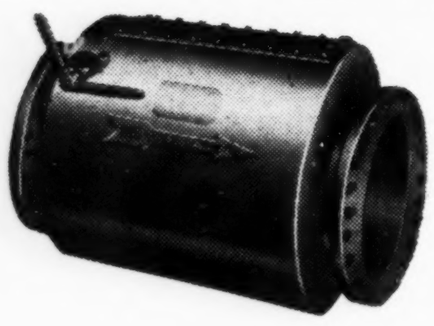


Extra power and double priming action to de-water faster. Built to outlast cheaper pumps by thousands of hours.



Heavy duty 2" to 10" models for low or high head requirements. Super-Jet pumps for pressures to 275 lbs. Diaphragm and caisson pumps. Get catalog.

THE JAEGER MACHINE COMPANY
Columbus 16, Ohio



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DISC TYPE
CHECK VALVE

Flanged and
Fabricated in Steel

For *GAS* and *AIR*—
LOW and *HIGH PRESSURES*

Can be supplied for use with any pressures. Easily lubricated through grease fitting. Indicator shows position of disc. Can be counter balanced for vertical jobs. Dash pot can be installed to prevent chattering when passing high velocity gas or air.

NORWALK VALVE CO.
South Norwalk, Conn.

SALES SLANTS

TWO OUTSTANDING examples of salesmanship in the face of competition and doubt were cited in the October issue of "The Magic Flame," house organ of United Cities Utilities Co., Chicago, by Vice President R. L. Sieben. UCU is a holding company owning small properties scattered from Minnesota, Wisconsin and Illinois through Tennessee, Georgia and other southeastern states. The following is briefed from Mr. Sieben's open letter to all employees:

"Once upon a time there was a little gas company down in the Tennessee valley which in 15 years had been able to convince only 231 customers to use gas. During 1945 the town sold $12,851.27 worth of gas, and merchandise sales for the year totaled $2227.29. Everyone apparently was convinced that TVA competition was too tough; everybody, that is, except one man! Early in 1946 a man appeared who did not know the job could not be done. In 1947 the town's gas sales reached almost $44,000, an increase of $26,000 over the previous year. Merchandise sales were $65,775, the largest ever made by any town in UCU, and merchandise profits were nearly $9000, four times as great as the total sales in 1945. Four hundred seventy-seven customers were using gas at the end of 1947. The man proved it could be done. He did not know he was licked.

"The town was Shelbyville; the man was Ed Mack.

"Recently many of our towns have been complaining that sales are too tough to get, competition is too great, and merchandise profits cannot be made. One of our towns, however, decided to stop whining about the situation and do something about it. An "Old Stove Roundup" campaign was carefully planned and ran from Sept. 8 to Oct. 8. During the 30-day period 32 gas ranges were sold for a total of $7631.22; 16 replaced gas ranges and 16 replaced stoves using other fuels. Total expense, including publicity, prizes and a gas range which was given away, was $650. Net profit was $1000. A backlog of orders is expected to produce a minimum profit of $1000 in October and the same amount in November. During the last week of the campaign five employees were credited with from one to eight sales. The merchandise profit quota which looked hopelessly unattainable six weeks ago is now almost definitely assured. The town was Gainesville; the promoters were Paul Howard and Eddie Lee Roberts."

THE GAS WATER HEATER sales promotion campaign for 1950, which will be of seven months duration, from March 1 to Sept. 30, will again hinge on the Court of Flame theme and seal, according to Ralph R. Towne, chairman of GAMA's water heater division sales promotion committee.

The drive, which promises to be bigger and better than 1949's, will capitalize on the additional selling job accomplished this year in stressing the sale of quality water heaters and will emphasize the value of the Court of Flame seal as an industry guide.

The 1950 program will use an "All Aboard" motif embodied in a tag-type water heater sales contest similar to the tag contest conducted in this year's campaign but having the added advantage of making it possible for all salesmen to win prizes. These will be selected from a merchandise prize catalog, and it is estimated that more than $180,000 worth will be given out.

Meanwhile, 78 winners in the third

Here's The LOW DOWN on HIGH PROFITS in GAS RANGES

1. Gross margin of profit on *gas ranges* averages 40.8%—compared to 33.9% on electric ranges. (See Table at right)

2. Your gross profit, therefore, is 6.9% *greater on gas ranges* than on electric ranges.

3. This means that $1000 of your money invested in gas ranges will give you a *gross profit of $408*—while $1000 invested in electric ranges will give you a *gross profit of $339*—*or $69 less on electric ranges than on gas ranges!*

4. But this is only half the story! Your *total* gross profit depends not only on the gross margin per range sold, *but also on how often you turn your range stock.*

5. *Gas ranges outsell electric ranges* in this area by a wide margin. The average dealer, therefore can turn his stock of gas ranges *many times as fast* as he can his stock of electric ranges! And *the greater the ratio of gas range sales to electric range sales, the greater the total profit.*

6. For example:

   If you invest $1000 in gas ranges and the same amount in electric ranges—and in a given period turn each stock once, you make out like this:

Gross profit on gas ranges	$ 408.00
Gross profit on electric ranges	$ 339.00
Extra profit on gas ranges	$ 69.00

   If you turn your $1000 stock of gas ranges *twice* while you turn your $1000 stock of electric ranges *once,* this is what happens to your profit:

Gross profit on gas ranges—2 turns	$ 816.00
Gross profit on electric ranges—1 turn	$ 339.00
Extra profit on gas ranges	$ 477.00

   If you turn your $1000 stock of gas ranges *5 times* while you turn your stock of electric ranges *once,* your profit picture looks like this:

Gross profit on gas ranges—5 turns	$2040.00
Gross profit on electric ranges—1 turn	$ 339.00
Extra profit on gas ranges	$1701.00

7. From the accompanying table you can see for yourself just *how much more profit you make on gas ranges* than on electric ranges, depending on what the ratio of gas range sales to electric range sales is in your store.

8. So what?

   No matter how you figure it, *it pays to concentrate your sales effort on gas ranges. They are easier to sell—they give you a greater percentage of gross profit per unit—they sell in greater volume—and they give you greater total profit.*

Gross Profit on Gas Ranges and Electric Ranges at Varying Stock Turn Ratios

(Based on stock investment of $1000 each in gas ranges and electric ranges)

Figures shown are an unbiased compilation of 8 well known gas range lines and similarly 8 well known electric range lines. Figures represent averages on 4 to 8 range models in each line. (Prices used: F.O.B. Pittsburgh, tax included)

No. of Turns Gas Ranges	No. of Turns Electric Ranges	Gross Profit Gas Ranges	Gross Profit Electric Ranges	Extra Profit on Gas Ranges
1	1	$408	$339	$69
2	1	816	339	477
3	1	1224	339	885
4	1	1632	339	1293
5	1	2040	339	1701
6	1	2448	339	2109
7	1	2856	339	2517
8	1	3264	339	2595
9	1	3672	339	3333
10	1	4080	339	3741

For your own comparison select the ratio that applies to your store.

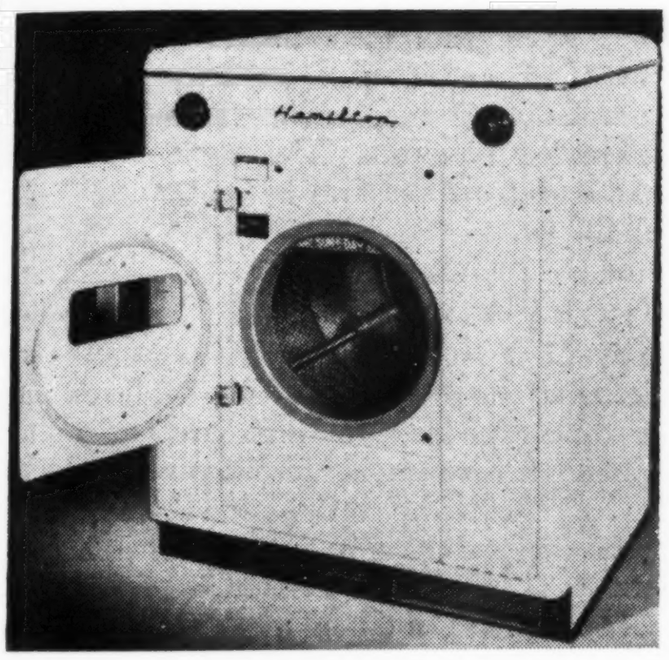
THE ABOVE CHART, which may be of value to other utilities in promoting dealers on the advantages of selling gas ranges, appeared in a recent issue of "Gas Appliance Dealer," the external house organ of the Peoples Natural Gas Co. and Manufacturers Light & Heat Co., Pittsburgh. Figures given are for prices in the Pittsburgh area.

quarter of the Court of Flame sales campaign have been announced by GAMA's sales promotion committee. Prizes of U. S. savings bonds ranged in value from $25 to $300 for sales of the most top quality gas water heaters for the period July 1 to Sept. 30. In addition to these prizes, 200 extra prizes made of Fiberglas were presented by Owens-Corning Fiberglas Corp. to the winners.

The contest is now in its final quarter and grand prizes will be awarded at the close of the competition Dec. 31, at which time Buick super sedans will be presented to the utility salesman and the dealer salesman who record the highest number of sales for the entire year.

AT 3 O'CLOCK Wednesday, Nov. 2, the 100,000th Hamilton automatic Fluff-Dri clothes dryer came off the line at Two Rivers, Wis. In appropriate ceremonies P. F. Sampson, president of the Sampson Co., Chicago, presented the dryer to W. Obermueller, appliance buyer for Marshall Field & Co., Chicago.

Feted at the ceremonies were E. P. Hamilton, president of the Hamilton Manufac-



turing Co., who made the award through Mr. Sampson and J. Ross Moore, inventor of the tumbler type household clothes dryer, and now chief dryer research consultant for Hamilton.

Hamilton has been manufacturing dryers since 1937 and is confidently looking toward the day when it will be celebrating the production of its millionth dryer. The one which Mr. Obermueller received was equipped with Hamilton's new Sun-E-Day ultra-violet lamp which creates enough ozone to give a fresh air smell to clothes, and the ultra-violet rays assist in the destruction of airborne bacteria.

A NEW MODERN "Room Ideas for Better Living" book has been prepared by American Radiator & Standard Sanitary Corp. for use in advertising promoting and merchandising heating and plumbing products. The book, which sells for $1, is an attractive compilation of monthly folders American-Standard has been circulating.

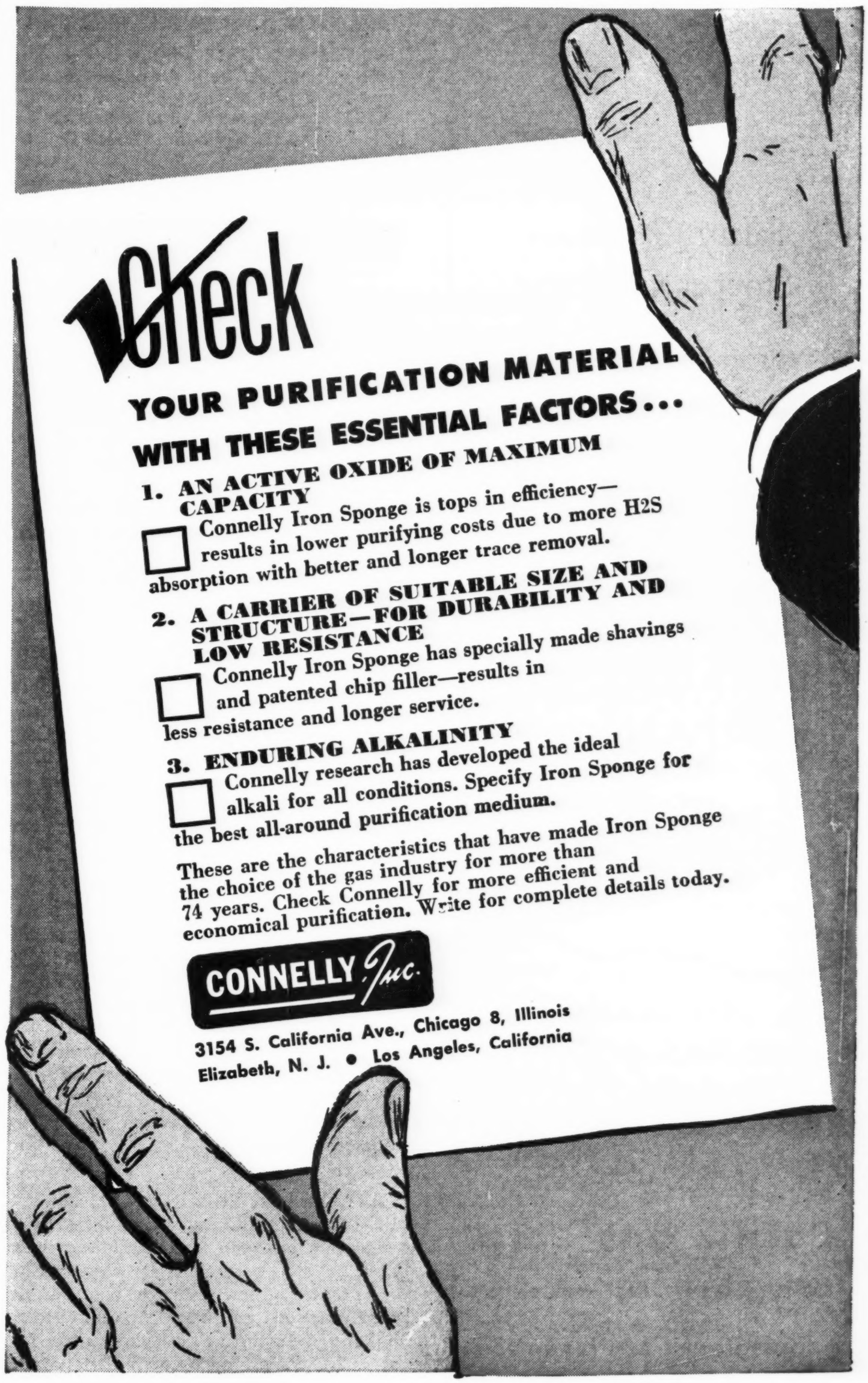
Included are 16 of the most popular room scenes shown in full color. The book is intended to be placed on store counters for use in sales presentations, for help in making calls in the home, and for lending to interested prospects for detailed study.

Rooms included are kitchens, bathrooms, and basements.

INVASION INTO the medium-priced home construction field by year 'round air conditioning was reported by Harold Massey, assistant managing director of GAMA, in his talk before the AGA residential section at the annual convention in October.

Mr. Massey reported that a story in *The American Builder* for June 1949 told how dealers in Wichita, Kan.; Columbus, Ohio; Anniston, Ala., and Sacramento, Calif., have sponsored a type of medium-priced construction which, through elimination of certain units in the house, offsets the increased cost of an air-conditioning installation. Included in these units are such things as basement excavations and porches, screens, and storm sashes. These latter items are eliminated through the use of fixed glass in windows. Chiefly, however, the houses are designed in such a manner that ductwork is held to a minimum.

A NEW SALES gimmick intended to induce husbands to buy their wives a Kitchenaider cabinet sink for Christmas has been devised for Youngstown Kitchen dealers by Mullins Manufacturing Corp., Warren, Ohio. It is a plastic miniature model of the 66-in. Kitchenaider, slotted in the back to serve as a bank and designed to be placed on the Christmas tree of the lady receiving the gift. Mullins is backing the Christmas program with extensive consumer magazine and local advertising.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HERE'S A DOUBLE winner in the quarterly Court of Flame gas water heating sales contest. D. A. Bell, president of Bell Plumbing & Heating Co., Denver, is shown receiving first prize of $300 in savings bonds from Roy G. Munroe, superintendent of dealers and builders, Public Service Co. of Colorado. Shown at center is G. B. Buck, vice president of Public Service Co. Mr. Bell also won the first award in the second quarterly contest.

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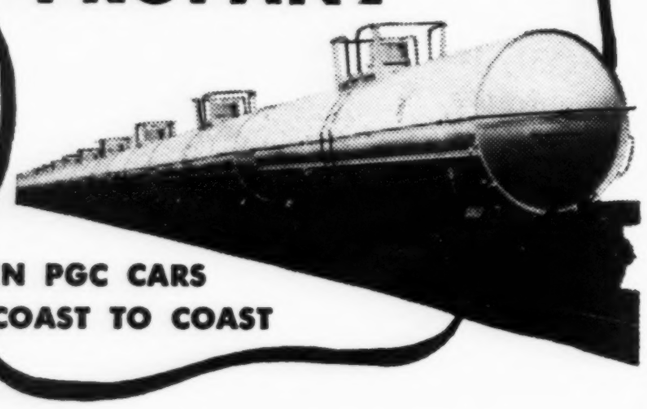

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CATALOGS

PITTSBURGH EQUITABLE METER DIVISION, Rockwell Manufacturing Co., 400 N. Lexington Ave., Pittsburgh, Pa.—A brochure titled "Review of Meter and Regulator Problems in Conversion from Manufactured to Natural Gas" reports information gathered by personal interviews and reviews published literature on methods of keeping meters and regulators in satisfactory operating condition during changeovers. Various changeovers throughout the country are considered chronologically and the literature quoted is listed in a complete bibliography.

BAILEY METER CO., Cleveland 10, Ohio —Design improvements and new applications for the Bailey combustibles recorder are featured in Bulletin 150-A, "Bailey Combustibles Recorder," which is now being distributed. Drawings and photographs explain the operation of this electronic type instrument which operates on the catalytic combustion principle, and typical applications are given.

MUELLER CO., Decatur, Ill., has published an illustrated, 96-page catalog, No. 55, which presents its full line of No-Blo gas service connections and equipment for use with low, medium or high pressures. Gas service tees, service valve tees, service line stopper fittings, service clamps, gas main stops, curb stops, curb boxes, meter stops, meter bars, gas regulators and drilling machines are included.

CATERPILLAR TRACTOR CO., Peoria 8, Ill.—Clearing, ditching, stringing, stabbing, wrapping, laying-in, and backfilling operations on pipeline projects are presented pictorially in a new 12-page booklet, "It's Caterpillar All the Way." According to the bulletin, the company's diesel track-type tractors, bulldozers, and Caterpillar powered pipe-laying equipment on jobs throughout the U. S. and Canada are helping in the completion of more than 36,000 miles of scheduled pipelines. The booklet may be obtained from the firm by requesting Form 12400.

THOMAS C. WILSON INC., 21-11 - 44th Ave., Long Island City, N. Y.—Bulletin 380 describes the complete Wilson-Dudgeon line of tube expanders for high pressure boiler tubes, super-heaters, economizers, water walls, circulating tubes, downcomers and risers in stationary and marine steam generators. The catalog describes Model 38 tube expanders for 1-in. to 4½-in. OD tubes with various roll lengths for tube sheets in thicknesses of ½ in. and more.

CHARLES ENGELHARD INC., 850 Passaic Ave., East Newark, N. J.—Bulletin No. 710 describes an analyzer which measures CO_2 content of flue gases through use of the thermal conductivity principle. No intricate outside circuits or mechanisms are needed, the bulletin states. This single instrument indicates proper air supply and temperature of the stack gases.

THE PARKER APPLIANCE CO., Cleveland, Ohio—Action of the Parker pressure gage snubber in protecting gages from line shocks and vibration while eliminating needle fluctuation for more accurate readings is described in Bulletin 380. Thirteen steps of adjustment available by use of three snubbing pins in a side-opening chamber out of the line of flow are listed.

ECLIPSE FUEL ENGINEERING CO., Rockford, Ill. — "Eclipse Gas-Fired Forge Furnaces" is the title of Bulletin E-3 which describes and illustrates the improved line of Eclipse forge furnaces. The new catalog also shows blowers, mixers, diluters and air control valves which can be used in connection with the furnaces. Installation diagrams and specifications are included.

NEW PRODUCTS

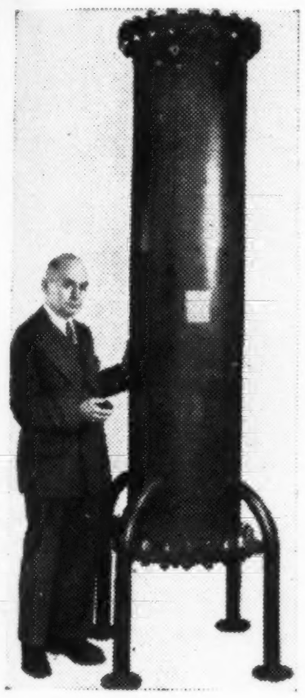
Safety Gas Stops

HAYS MANUFACTURING CO., Erie Pa.

MODELS: Securo and Key-Lok.

DESCRIPTION: These two safety gas stops have just been added to the firm's line of gas service products. Both are tamper-proof, according to the manufacturer. Bodies are cast iron and plugs are cast bronze. They are available in sizes from ¾ in. to 2 in. black or galvanized, and in various styles. Copies of Folder 120, which describes these items, may be obtained from the manufacturer.

Gas Purifiers



BAKER & Co. INC,, East Newark, N. J.

MODELS: M, DM and E Deoxo purifiers.

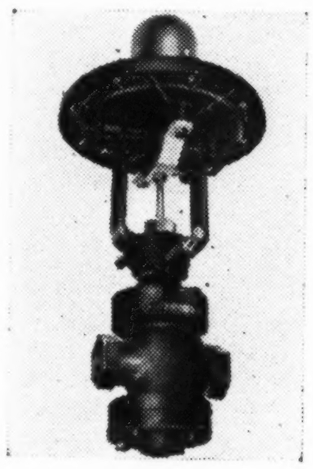
APPLICATION: For catalytic purification, hydrogenation, and oxidation of gases.

DESCRIPTION: Newly developed Engelhard catalysts, which are said to last indefinitely, have resulted in three expanded Deoxo processes. The M Deoxo purifier provides for the catalytic combination of oxygen and carbon monoxide to form carbon dioxide in gases that do not contain hydrogen. Gas temperatures must be maintained at 100°C or higher for complete reaction. It may also be used for oxidation of CO to CO_2 in a hydrogen-rich atmosphere and for the oxidation of hydrogen in oxygen gas.

Model DM Deoxo purifier provides a simultaneous catalytic combination of CO plus H to CO_2 plus water vapor. Methane and water vapor are formed from the catalytic combination of CO and H, using Model E Deoxo purifier.

Sizes range from 200 to 100,000 cfh.

Control Valve



THE FOXBORO CO., Foxboro, Mass.

MODEL: Reversible-motor Stabilflo control valve.

APPLICATION: Designed to save time where changes must be made in existing installations, for convenience in test work or pilot plant operation, and for simplification and reduction in the stock of spare valves which the average plant must keep in reserve.

DESCRIPTION: In a few minutes and without the use of special tools, this valve can be changed from "air to open" to "air to

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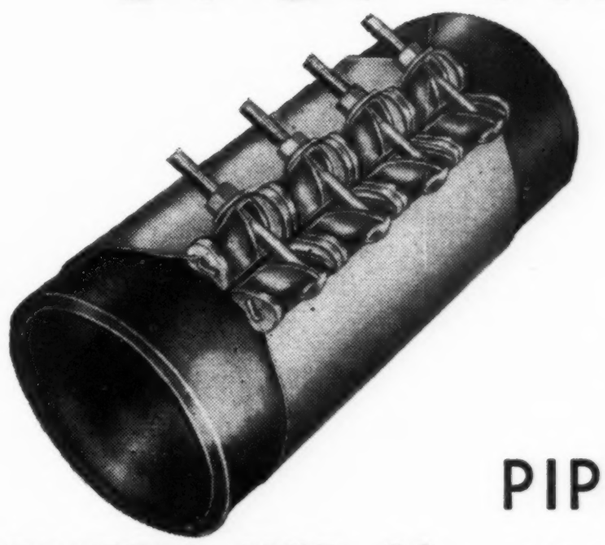

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LP-GAS SPECIALISTS—100% PLANTS—STAND-by—Enrichment—Peak Shaving. Twenty years experience. H. Emerson Thomas and Associates Inc., Westfield, New Jersey.

WANTED: USED CUTLER-HAMMER RECORDING Calorimeter or Thermeter. Illinois Electric & Gas Company, Murphysboro, Illinois.

PROJECT DESIGN ENGINEER—GRADUATE ENgineer. Design gas appliances and gas heating equipment. Heating and ventilating experience preferred. Knowledge AGA requirements desirable. Design experience essential. Age 28-40. Position in southern California. Address Box 275, GAS, 198 S. Alvarado St., Los Angeles 4, Calif.

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close" or vice versa and it is not necessary to remove the valve from its installation or to shut down the controlled flow.

The new reversible motor (for which patent application is pending) has a forged steel housing and is similar in general appearance to the conventional Stabiflo valve. To reverse the action of the valve motor it is necessary to remove the housing assembly, rotate it one-quarter turn, and replace it. This requires the removal and replacing of four bolts.

The valve is described and the reversing operation explained in the company's Bulletin 2268.

Sealing Compound

ARMITE LABORATORIES, 6609 Broad St., Los Angeles, Calif.

MODEL: Thread-Tite.

APPLICATION: For use on threads of any

type, including steel, aluminum, iron, brass, plastic, and copper.

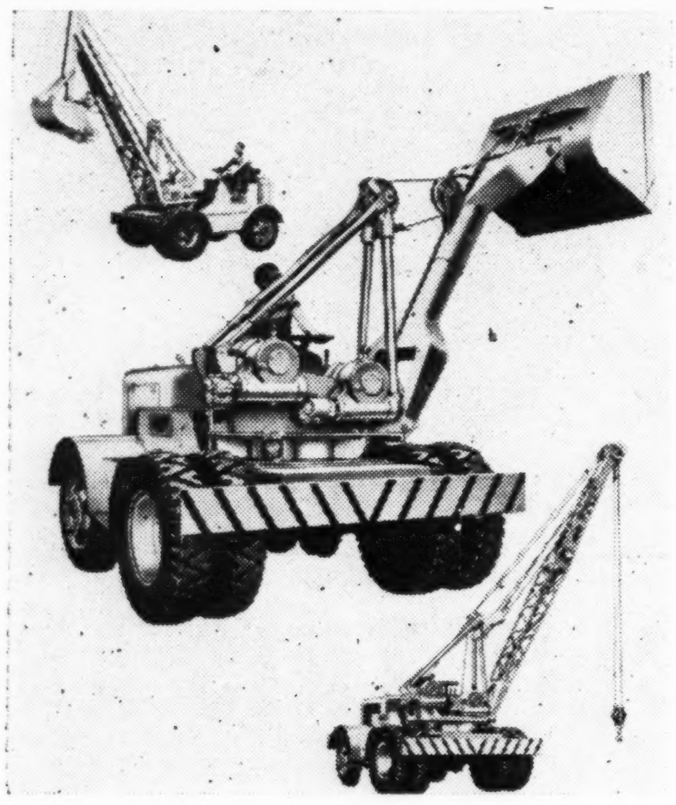
DESCRIPTION: The manufacturer claims that the application of this stick to any pipe threads before joints are made up provides a positive seal against gases, brine, acids, water, steam and ammonia at high and low temperatures. It is said that Thread-Tite will protect threads from seizing or galling and that, because of lubricating qualities in this compound, pipe joints, bolts and studs can be drawn tighter than is normally possible.

Loader

THE MANDT MANUFACTURING CO., 490 W. Goodale St., Columbus, Ohio.

MODEL: 1950 Mandt swing loader.

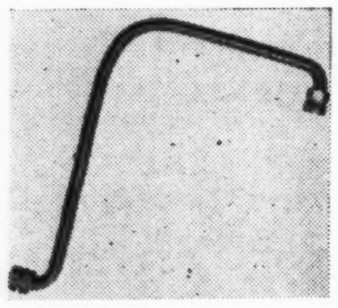
DESCRIPTION: This model features full hydraulic operation, 180° swing, and quick-change convertibility to mobile crane or backhoe. As a loader, the unit is designed for standard ¾-yd material bucket and up to 2-yd snow handling bucket. It can load from any point in a 10-ft swath and also



above-grade, can swing 90° to either side to dump, and permits work within 2 ft of trucks.

The machine's utility is increased because it can be converted to an excavator and trencher by installation of ⅓-yd backhoe attachment in place of loader or to a mobile 3-ton crane operating boom of 10 to 23-ft length which can be swung 180° without outriggers to pick up or place loads.

Gas Connector



TECHNIFLEX CORP., Port Jervis, N. Y.

MODEL: Flex.

APPLICATION: Designed to speed up installation of all gas appliances and to simplify cleaning.

DESCRIPTION: Constructed of flexible tubing with a female union at each end, the connector allows the range or heater to be moved away from the wall for installation and cleaning and to hug the wall closely when in operation. Available in 3-, 4-, and 5-ft lengths, the connector's flexibility permits bending at any angle.

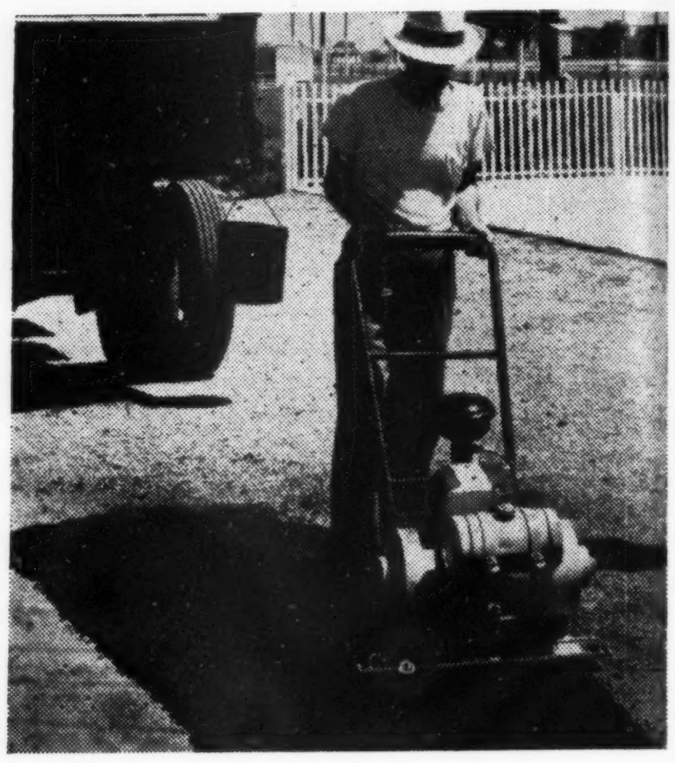
Impactor

WAYER IMPACTOR SALES CO., 12 N. Third St., Columbus, Ohio.

MODEL: 25-C Impactor.

APPLICATION: For super-tamping bituminous and dry concrete pavement patching, floor base and earth.

DESCRIPTION: Tamping impact has been increased to 1250 ft-lb delivered at a speed of 1900 blows per minute. Self-priming, constant speed carburetor, flexible break-



proof gas line, heavy duty fuel tank, anchored bolts and screws, long-life shock absorbers, and more efficient heating of the tamping-finishing plate are provided.

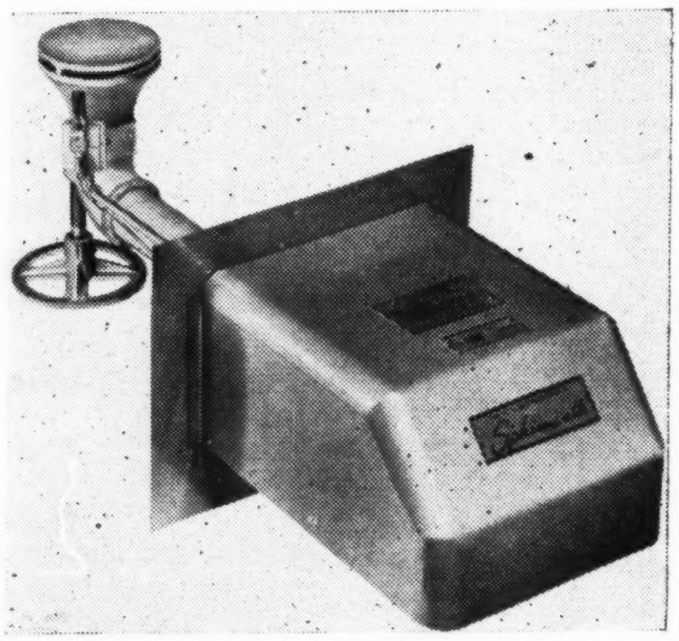
Because of compact size and overall weight of 240 lb, the Impactor may be carried in light trucks. Average fuel consumption is 1 gal per day.

Conversion Burner

C. L. BRYANT CORP., 4610 St. Clair Ave., Cleveland, Ohio.

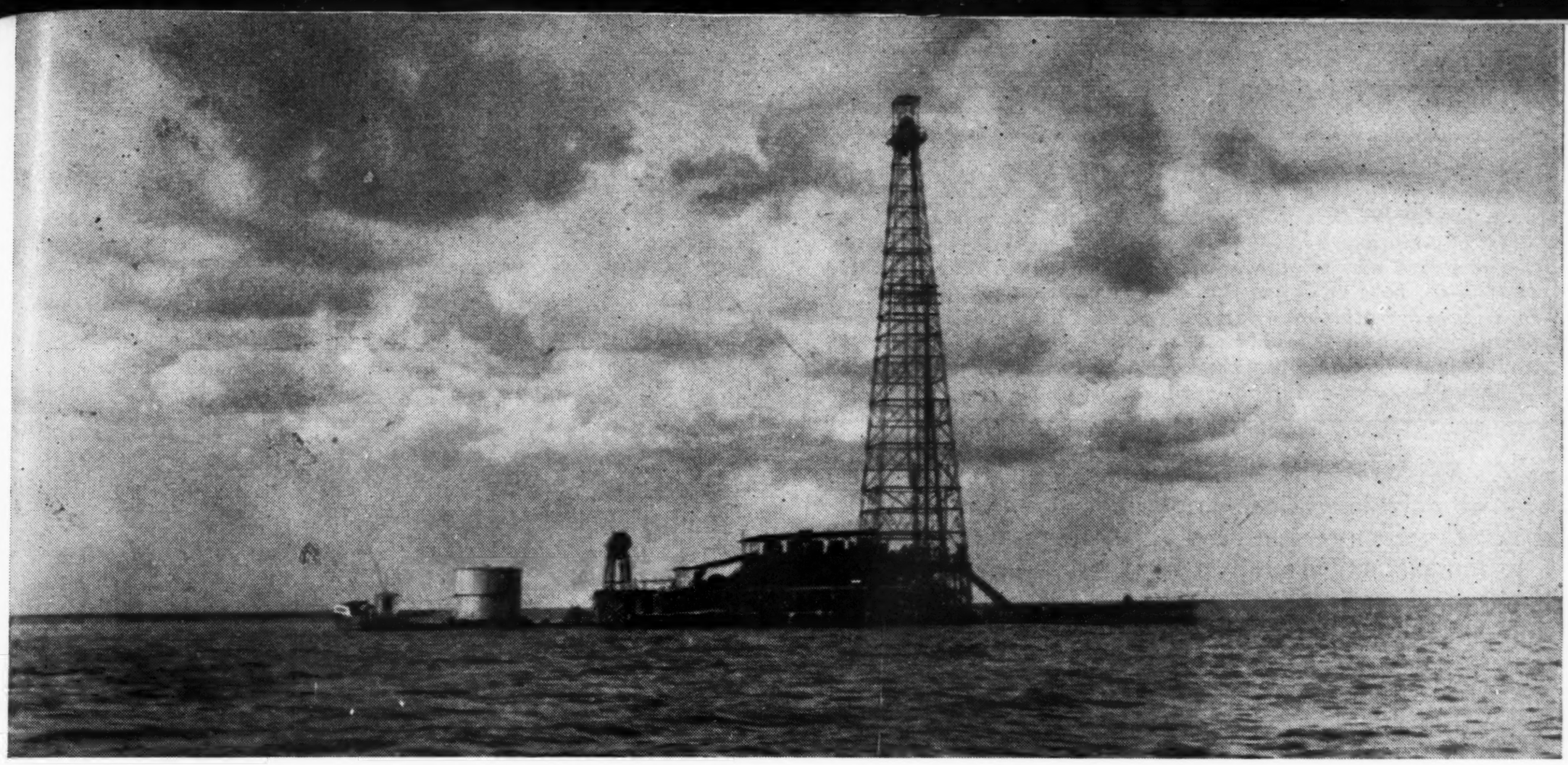
MODEL: Sphinx-ette.

APPLICATION: This conversion unit is adjustable for all gases and for all small and medium-sized heating plants. It can be



moved from one location to another.

DESCRIPTION: The AGA-registered Sphinx-ette features a new all-cast burner head. No refractories are required.. Other advantages, according to the manufacturer, include a needle valve adjustable orifice for quiet operation, exterior primary air control, adjustable secondary air door, and main shutoff and pilot valve.



DRILLING RIG, mud tanks, storage house, fuel tank, and other equipment are shown above. Unit is operated by Union Producing Co.

TIDELANDS GAS

Status And Prospects For Offshore Natural Gas

By MAJOR B. A. HARDEY

As the market for natural gas grows, and new lines are constructed, involving the expenditure of many millions of dollars, the question of adequacy of reserves is of increasing importance.

The banker is interested in the security of his investments or the investments of his clients. The consumer wonders if he will have a gas supply for expansion purposes.

As the frontiers of the petroleum industry are extended, it is of more than passing interest what the rate of discovery is, and whether oil or gas is found.

During the past three years one of the new frontiers to be explored is the tideland area off the shores of Louisiana and Texas. Oil had already been produced off the shore of California.

Of paramount interest to you who are engaged largely in the natural gas business is the question of what contribution this new off-shore development is making to the nation's natural gas reserves, and the availability of such reserves after they are discovered. In this treatise on the subject I shall try to give you my idea as to what might be expected in the way of gas recovery in the Gulf Coastal area, and tell you about some of the problems encountered in the development program.

ASIDE from the fact that the Gulf area is submerged, there is no essential difference between the type, magnitude, and structural habit of anomalous areas in the Gulf and those on land. Also, it has been demonstrated by well data that the geologic section thus far penetrated by the

(Continued on next page)

First Marine Gas Well In Operation For Union

The following article states that State-Lake Raccourci No. 1 is the first marine gas producer brought in by Union Producing Co. To the best of the knowledge of GAS' editors, it is the first marine gas well, as such, operated by any company.

TAKING a new stride in its never-ending quest for natural gas reserves, Union Producing Co., Shreveport, La., recently brought in its first marine producer . . . the State-Lake Raccourci No. 1 wildcat in LaFourche parish of deep south Louisiana.

The well was a 100% marine operation from start to finish and when it was completed as a gasser on Sept. 17, it marked the company's first successful venture in that newest phase of modern drilling. Drilling records in the Shreveport general office listed the event merely as completion of another gas well in the New Orleans district, but behind that rather matter-of-fact statement could be found a story of men tackling new methods and new problems to find more natural gas for United's vast system. The exploration and production forces had conquered the marshlands in previous tests, but never before this year had they probed any of the great salt water expanse that lies in the coastal regions adjacent to the Gulf of Mexico.

State-Lake Raccourci No. 1 was drilled out in Lake Raccourci, a large body of shallow salt water in the northern end of Timbalier Bay. For all practical purposes it is actually in the Gulf waters, because 14 miles of salt water is all that lies between the gasser and the open Gulf of Mexico.

The wildcat is approximately 50 airline miles south and

(Continued on page 82)

Major B. A. Hardey, an independent operator, is a past president of the Independent Petroleum Assn. and has long been prominent in activities of the Independent Natural Gas Assn. of America.

His paper was originally presented at the annual meeting of INGAA, held in Dallas Oct. 31. It portrays the possibilities in drilling for off-shore natural gas, the problems which form obstacles to its profitable recovery, and discusses fully the 11 (possibly 12) gas fields that have been discovered as a result of Texas-Louisiana off-shore drilling.

drill is comparable to that found on land. Therefore in the Gulf we have two of the prime requisites for gas and oil reserves—structure and sand conditions.

In the submerged areas it has been shown both by geophysics and geology, as well as by the drill, that there is a wide range of structually anomalous areas. Thus far the range includes structures on which the caprock of a shallow salt dome has been encountered at 1600 ft, to the Kerr-McGee Block 28 gas discovery in the Ship Shoal area south of Morgan City, off Terrebonne parish, La., where no salt was encountered to a depth of 14,451 ft. In between these two extremes fall the moderately deep domes in which salt was encountered in some cases between 4000-8000 ft.

The areal extent of the submerged structures compares favorably with those on land. Round-shaped, shallow domes vary from a diameter of one to two miles, to an oblong shape having a width of three miles and a length of almost six miles. This type compares in size to some of the earlier discovered land domes in the Texas and Louisiana Gulf Coast areas. Some of the deeper type anomalies are of the order of five miles plus in width and 15 to 20 miles in length with their long axes roughly parallel to the present coast line which is parallel with the regional strike of the beds.

A bibliography entitled "Offshore Petroleum Developments" has just been published by Southwest Research Institute, 312 Oil & Gas building, Houston, Texas.

As on land, both geological and geophysical data have shown that faulting is present in the sedimentary section overlying both the deep and shallow structures. It is interesting to speculate how these same structures would have been mapped geophysically by the seismograph 10 or 12 years ago. Undoubtedly, they would have appeared as relatively smooth, idealistic anomalies. Today, however, we know that such is not the case. It is true that too few wells have been drilled off shore to delineate properly the fault patterns, but in all probability they follow the habit of those on land.

The potential producing horizons associated with those off-shore structures are many. In the Gulf of Mexico off Louisiana, production can be expected from sands in the Pliocene and Miocene in depths from around 1500 ft to 20,000 ft plus. Off the Texas coast, Pliocene, Miocene as well as Oligocene formations are present as potential gas and oil reservoirs. Some of these sands are no doubt lenticular in nature since they pinch out on the flanks of some structures. Others are widespread blanket reservoirs overlying the deeper uplifts.

To date there have been eight oil fields discovered in the coastal Gulf waters of Louisiana. Range in depth of production was from 1700 to 10,400 ft. The highest initial potential was at Kerr-McGee's Block 33 test off Cameron parish, which was completed in August of this year for 934 bbl per day on 14/64-in. choke. The discoveries represent a wide geographical range extending from Breton sound on the east coast, east of the Mississippi river, to Cameron parish on the extreme west coast.

In 1947 there was one field found. Kerr-McGee brought in the discovery well for Block 32 field in the Ship Shoal area from a depth of 1734 ft for 600 bbl per day. This was the first oil discovery of the post-war drilling period in the Gulf.

Four Wells This Year

The California's Block 69 field in Main Pass, also east of the Mississippi river, was brought into production in August 1948, from a depth of 5850 ft. The well flowed 205 bbl per day on 5/32-in. choke. Three days after this completion, Humble finalled its Block 18 well in Grand Isle, south of New Orleans, for 806 bbl per day from 4584 ft. In November 1948, Humble completed the Block 16 discovery, which is also in the Grand Isle area.

Thus far in 1949 there have been four new oil fields found in the Gulf. The California company's Block 2 well in the Bay Marchand area, also south of New Orleans, was completed in March for 225 bbl per day. In the same month Humble potentialed its Block 34 well in S. Timbalier for 456 bbl per day.

No further discoveries were completed until August 1949, when Barnsdall finished its Block 32 field well in Breton sound for 187 bbl per day.

The first gas field (Block 36 in Breton sound) was discovered by Barnsdall in March 1948. Four months later Superior completed its Block 71 gas well in the Vermilion area, south of the town of Crowley. This was followed in August and November by Magnolia's Block 72 gas well in Ship Shoal area and Block 45 gas well in the Eugene Island area, south of Morgan City. This totals four gas discoveries in 1948.

In April 1949 Humble led off with a gas well on its Block 30 field in West Delta area, southeast of New Orleans, while Superior completed its Block 76 gas discovery ap-

TABLE 1. GULF GAS COMPLETIONS

Louisiana

Operator	Well No.	Area	Completion Date	Total Depth	Results
BARNSDALL	A-1	Breton Sound	3-23-48	10,609	2,360 MCFGPD; ¼-in. ch. S.I.
SUPERIOR	A-1	Vermilion	7- 2-48	13,628	5,911 MCFGPD 53 B. dist. on 20/64-in. ch.
MAGNOLIA	A-1	Ship Shoal	8-20-48	9,355	118,000 MCFGPD open flow.
MAGNOLIA	A-1	Eugene Island	11-24-48	13,636	29,500 MCFGPD open flow.
HUMBLE	A-1	West Delta	4- 7-49	7,500	28,200 MCFGPD ¼-in. ch.
SUPERIOR	C-1	Vermilion	4-27-49	11,603	7,565 MCFGPD 12 B. dist.
STANOLIND	A-1	West Cameron	5-21-49	8,814	3,590 MCFGPD 40B. dist.
PURE	A-3	Vermilion	6- 8-49	10,379	40,000 MCFGPD Calc. open flow.
KERR-McGEE	A-1	Ship Shoal	7-20-49	14,451	3,460 MCFGPD 69 B. dist. ¼-in. ch.
MAGNOLIA	A-1	Eugene Island	7-22-49	12,067	3,600 MCFGPD 22B. Dist. 12/64-in. ch.
SUPERIOR	A-1	West Cameron	9-16-49	9,380	3,555 MCFGPD 7B dist. ¼-in. ch.
Texas					
STANOLIND et al	Sec. 245	Galveston County	?	11.017	5,122 MCFGPD 48 B. dist.

proximately three weeks later in the Vermilion area. Stanolind's Block 45 well in West Cameron area was completed in May for a gas discovery. The second test, which was drilled from the same platform and deviated to a point 1000 ft south of the first or vertically drilled gas well, was completed as an excellent oil well 69 ft lower structurally than the gas well. In June, Pure finished its Block 39 gas well in the Vermilion area. The following month, and only two days apart, Kerr-McGee finalled Block 28 gas well in Ship Shoal area, while Magnolia gaged its discovery of the Block 110 field in Eugene Island area. Superior recently completed a test in Block 149, West Cameron area, as a gas discovery.

Nineteen forty-nine marked the first discovery of either gas or oil in the coastal Gulf waters of Texas in the *current* drilling campaign. Stanolind, Ohio and Melben have a gas-distillate well in their Sec. 245 test 10 miles south of Galveston. This gas discovery is one of five tests in Texas Gulf waters, the other four being dry holes.

Total Number Drilled

The completion of this well will bring the total number of gas discoveries in the Gulf to 12, but only 11 if Stanolind's Block 45 field develops into an oil field as it seems destined to. In every instance, except where used for fuel on drilling tests, these discoveries are shut in at the present time.

It is of interest to note that the average total depth to which these gas wells have been drilled is 11,000 ft. The average depth at which gas production has been obtained is 7528 ft.

As of today, there are 14 active wildcat operations in the off-shore waters of Louisiana, any one of which may well be the next oil or gas discovery. Further, it has been estimated that 75 good geophysical seismic prospects have been found in Louisiana Gulf waters. The number in Texas waters is estimated at 25.

Table 1 is a summary of gas completions to date in the Gulf area off the shores of Louisiana and Texas.

The seismic geophysical cost per crew month is roughly twice that in the marshlands, and more than twice that on the dry land to the north. Bonus or lease cost has been higher than prices on land in the marshes.

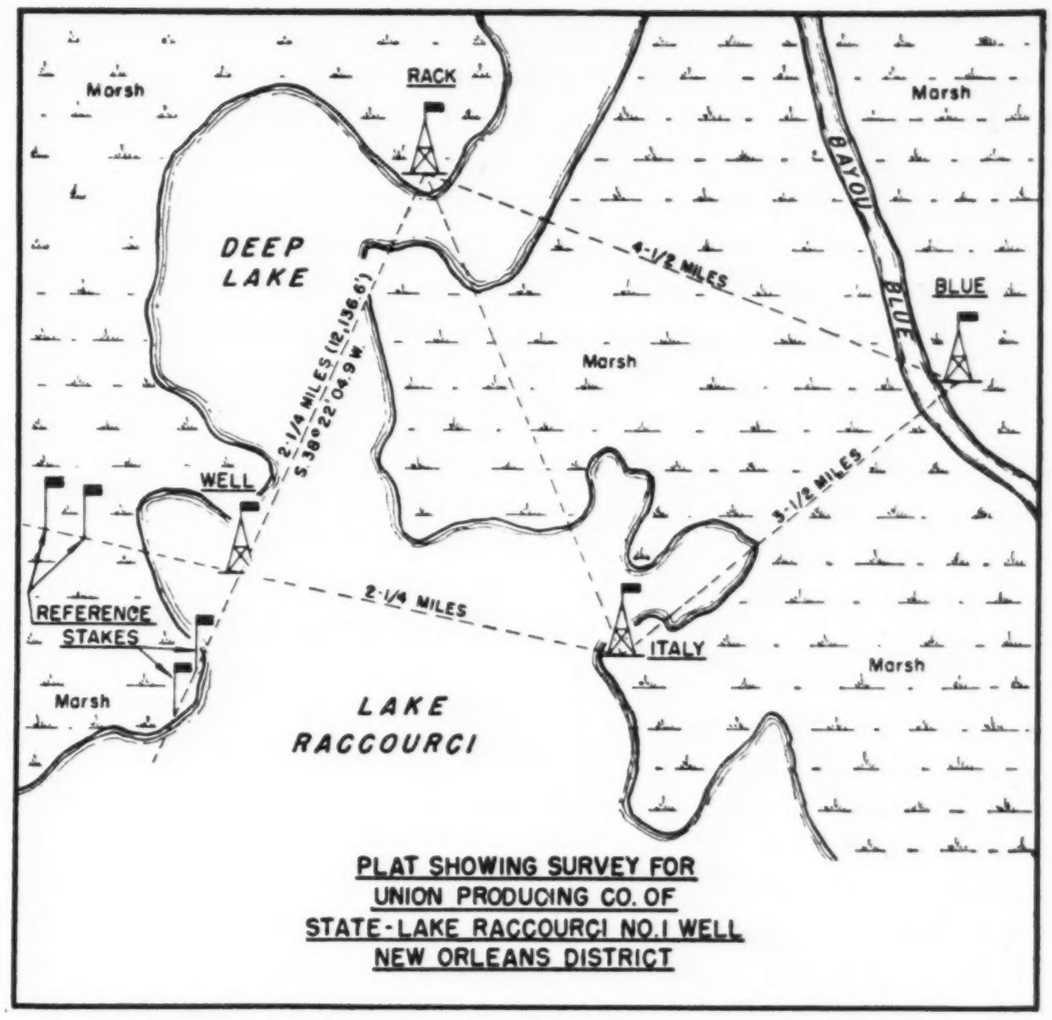
The cost of exploration wells is from 2 to 4 times higher than the average marsh well, and from 3 to 5 times higher than the dry land wildcats. Development wells cost more than on land, but after a good field is brought in there will be fewer development wells to drill, because a wider spacing can be used due to larger tracts, the majority of the Louisiana tracts being 5000 acres each, while those in Texas are 640 acres or greater.

Correspondingly, the hazards of operation are greater than in the marshes and much greater than on dry land. Hurricanes, fogs, and corrosion contribute to the difficulties encountered. Derrick platforms, properly but expensively built, will stand the winds, currents and waves. The costly drilling barges will ride out the storms.

Gas can be transported only by pipeline, and only after several wells are in, but oil can be transported from the discovery date by barge and later by pipeline when sufficient production is obtained.

The price of off-shore gas, *in general,* will be established by the on-shore price being paid or to be paid in the future. The transportation costs from wellheads to the transmission terminal on land will affect the price at the wells located off-shore.

Any discussion of gas reserves in the Gulf of Mexico should be prefaced with the statement that too few wells have been drilled and completed to give a particularly accu-



PLAT SHOWING SURVEY FOR
UNION PRODUCING CO. OF
STATE-LAKE RACCOURCI NO.1 WELL
NEW ORLEANS DISTRICT

PLAT SHOWING survey for Union Producing Co. of State-Lake Raccourci No. 1 well, New Orleans district.

rate picture of the potentialities of the area. Thus, from the reservoir engineer's viewpoint, large reserves cannot be proved at this time. It is possible, however, by using conventional computing methods, to arrive at a tentative reserve estimate which is within the realm of reason. To those experienced in exploration in the Gulf Coast area, there is sufficient evidence to show large reserves like those in the adjoining land area.

For example, one estimate predicts an ultimate reserve of 786 billion cu ft for the *present* 11 gas well areas in the Louisiana Gulf of Mexico. Of the 11 gas fields, two gas fields in the Eugene Island area (based on sand thickness and the areal extent of the producing segments in which the wells are located) have been given a possible minimum of 150 billion cu ft and a probable maximum recovery of 475 billion cu ft. It is not inconceivable that the estimated reserves for these two fields might reach 2 trillion cu ft. This is exclusive of any condensate or oil that may be present.

Determining Potentialities

Another approach to an appraisal of the gas potentialities of the open Gulf would be to superimpose only the gas fields now producing on land on a contiguous submerged off-shore area. For example, taking an area approximately 31 miles inland, north of the West Cameron area, and comparing this to a similar sized water area off the southwest Louisiana coast, we might predict a reserve of 565 billion cu ft in the West Cameron area, which is 72 miles paralleling the coast line by 31 miles perpendicular to the shoreline. By going through the same procedure, we might predict that 1 trillion cu ft would be a reasonable figure for the Ship Shoal area off Terrebonne parish. Finally, we would, by transposition of gas fields along the entire Louisiana coast estimate that there could be 5 to 7 fields with estimated ultimate recoveries of 50 billion to 400 billion each, and from 2 to 4 fields with ultimate recoveries of from 25 to 50 billion each in the Gulf waters of Louisiana.

Unquestionably, the Gulf of Mexico gas is potentially significant, and additional discoveries will further enhance these potentialities. This would constitute a total reserve of approximately 4 trillion cu ft of gas. It is pointed out

that the above estimate is based on the engineer's estimates on the present land reserves. Some new fields will be found, and when the present known fields are drilled up, the total could easily be double the above figures.

At this time I think it is premature to place an estimate on gas reserves under the Texas Gulf waters. These reasons are that too few wells have been drilled, and that the subsurface geological formations present a different picture on the whole as compared to that of Louisiana. Formations under Louisiana waters on the average are comparable to those under the Louisiana land area. In Texas waters they are somewhat different. Let it suffice to say there will be commercial gas fields under the Texas Gulf waters.

In order to market the present and future gas reserve in the Gulf of Mexico, it is obvious that the construction of one or more gathering systems must be planned and built.

The first pipeline to be constructed in the current period of development in the Gulf was an oil line laid in the Bay Marchand area off LaFourche parish in southeastern Louisiana. Three miles of 4-in. line was laid in water to 30 ft in depth. The time required was four weeks, of which 10 days were lost due to bad weather. In order to comply with U. S. engineer's regulations, it was necessary to bury the pipe 3 ft below the floor of the Gulf where the water was less than 8 ft deep. The line was wrapped, but not weighted, since it was believed that it would bury itself in the sandy silt of the Gulf bed. In the case of gas lines, where the diameter is over 10 in. it will be necessary to use a weighting material such as clamps and somastic coating sufficient to provide additional weight to the line and to protect against corrosion. In the event that the line traverses shipping lanes or fishing grounds it will probably have to be buried. The ditching involved will be accomplished by the jetting process.

A Practical Project

It is generally conceded that the laying of gas lines in the open water is a practical project. In Lake Maracaibo, Venezuela, an elaborate gathering system has been laid on the bottom of the lake at an average depth of 90 ft. From the Creole field off Cameron parish in southwest Louisiana, 1½ miles of oil line have been used for approximately 10 years to take the production to shore. Generally speaking, it does not appear to be more difficult in the Gulf than in the swamplands of southern Louisiana. It is true that bad weather conditions might interrupt the progress of laying the line but, in contrast to the transportation problems encountered in the swamps, the submerged areas present a somewhat easier problem in this respect.

United Gas Co., in 1941, elected to lay a 14-in. gas line 24 miles in length across Lake Ponchartrain, which is a land-locked salt water bay near New Orleans, rather than 37 miles around the lake in marshes. A somastic coating ½ in. thick was applied and no trouble from leakage has developed in the eight years in which the line has been in operation.

From the mainland of Saudi Arabia to the Island of Bahrein, a 17-mile 12-in. oil line was successfully laid. Particularly swift tides as well as submerged coral reefs and difficult corrosion problems were encountered, but the somastic-coated oil carrier was laid in 91 days, 65 of which were working days.

A plan has been proposed which is particularly adapted to the open waters of the Gulf whereby a trunk line could be laid from a plant on shore out to a central point in the open water. From this point, a smaller-inch gathering line would radiate to the gas fields in the submerged area.

In the final analysis, the "$64 question" is not "Can gas lines be laid in the Gulf 25 or 30 miles out?" but, rather, "Are the reserves sufficient in the individual field or fields to pay for the installations?" A guesstimate puts the ratio of cost of construction of a similar-sized line in submerged areas to that on dry land at from 2 to 1 to about 4 to 1.

This may appear exorbitant, but consider the cost of moving gas from the Rio Grande valley in Texas toward eastern termini. It is probable that the cost of gas carriers from the Gulf of Mexico fields will prove to be less costly than those from the Rio Grande valley area.

Cooperative Gathering Needed

Physical facts with respect to gas production on submerged lands demand joint co-operative gathering, maintenance, and physical care of the producing wells. The wind, water, and wave hazards demand it. An area gathering system, or systems, is the logical answer. The single gatherer, or the gatherers, must have financial inducement to engage in such a hazardous enterprise. This is the outstanding difference between normal gas field operations on land and gas operations off-shore. We are advised that under existing law such activity is permissible. It will probably be necessary that leasing regulations applicable to off-shore operations provide for this necessary authority.

The hazards and financial investments must be compensated by a set of favorable regulatory measures. Briefly, we feel that the following requisites are imperative to economical production in Gulf waters off Texas and Louisiana:

1. Ten-year leases to permit adequate time for development. Development is naturally slower than on land or marsh.
2. Low delay rentals to lower the operators' investment.
3. Large allowables to permit earlier reimbursement for monies expended.
4. Proper spacing regulations to permit economical and effective production.
5. Unitization of tracts.
6. Continued cooperation from the U. S. Coast Guard and U. S. Engineers.
7. Free geophysical rights to conduct exploration in the open waters.

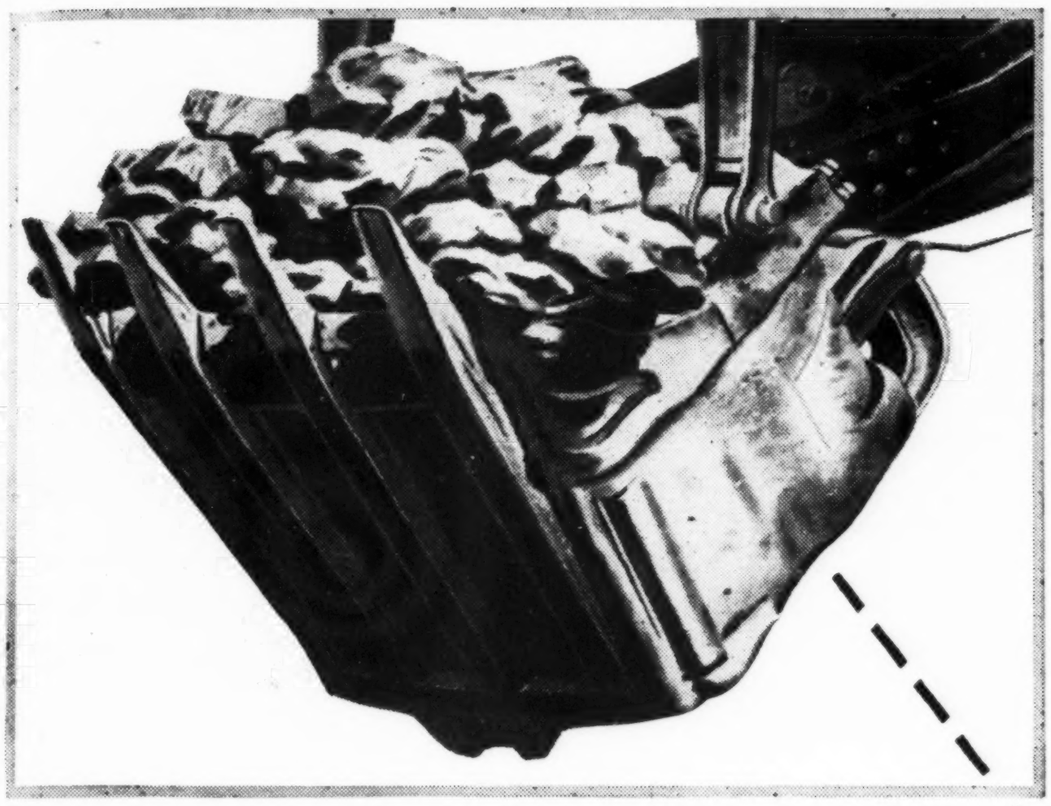
Union's Marine Gas Well

(Continued from page 79)

slightly west of New Orleans . . . placed like a lonesome sentinel out in the big body of salt water. Nearest producing well is Humble's test, three miles away, that was completed a few months ago as the discovery well for the area. Union's nearest production is in the Bay Baptiste area, some 13 miles to the northwest.

On open flow test the well gaged 17,600 Mcf of gas per day, but far more striking than its volume were the conditions under which it was located and drilled, and the fact that it becomes Union Producing Co.'s first completion in Gulf coastal marine drilling. From the time contracting geophysical crews moved in to make gravity and seismic recordings of the area until the day it was brought in, State-Lake Raccourci No. 1 offered a new challenge.

The new geophysical work that preceded location of the test was a new experience in itself, for it was the first time Union had ever sought likely gas-bearing formations in any of the vast outlay of salt water that borders the Gulf of Mexico. The first activity in the area was back in 1945 when a gravity meter crew was sent into the Raccourci region. Later came the "shooting" work, which resembled a small scale naval operation more than it did Union's normal methods of seismic exploration. Twice severe storms brought all operations to a halt, and on one occasion a barge with two crew members aboard was torn loose from



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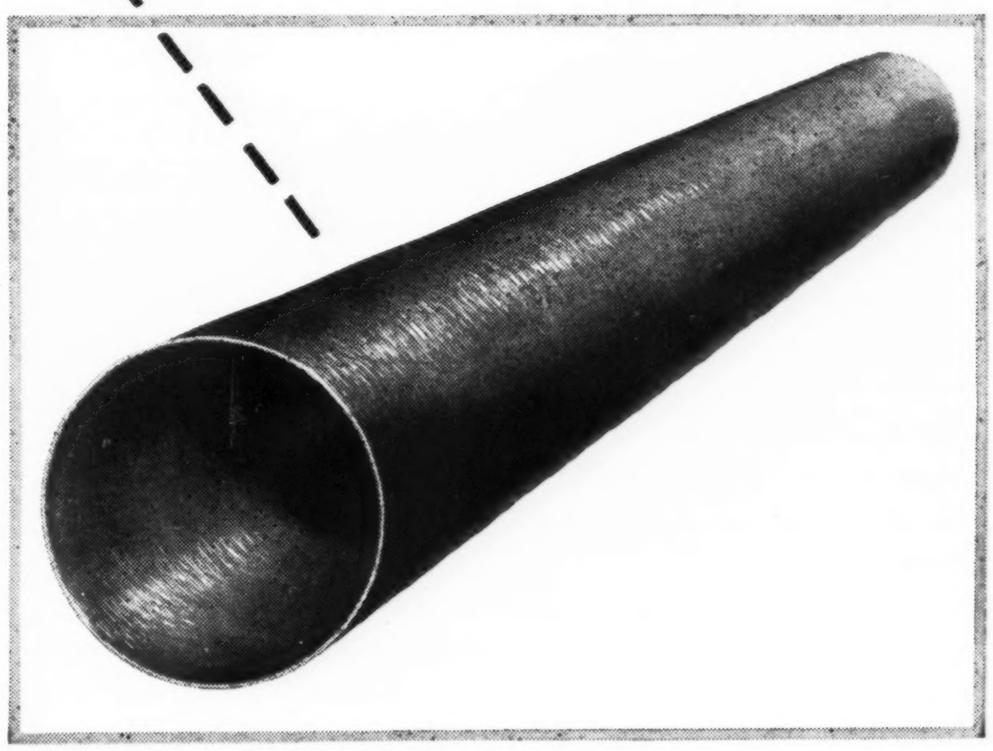

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UNION PRODUCING crewman sends seismometer overboard into the lake bottom for another recording.

its mother boat and blown down into Timbalier Bay. It was heading straight for the open Gulf of Mexico when an incoming shrimping boat rescued it. Another big blow tore the quarterboat loose from its moorings.

Seismic work in the Lake Raccourci area, like most shooting operations in the outlying shallow water lakes and bays adjacent to the Gulf, revolved around a "mother ship" known as the quarterboat. It provided a headquarters for the operation as well as living quarters for the crew. Smaller vessels in the shooting fleet such as the supply lugger, barges, recording bateau and motor skiffs used the quarterboat as a home base.

After permits had been obtained to shoot on these state-owned water bottoms, the initial work centered around the surveyor who placed the seismic lines or profiles along given bearings as requested by the geophysical department. The position of these lines was ascertained with respect to known land features such as bench marks, prominent waterways or points of land, channel markers, etc. To facilitate the transit work a portable tower that could be used in water as deep as 15 ft was employed.

Shot point and recording locations were located by chaining the actual distances with a measured line extending from a reel on the stern of a 30-ft speed boat. The shot holes were drilled with a gasoline pumper unit that provided water jetting power through 3-in. casing rotated manually. A small barge moved about by a motor skiff was used to drill the holes, and the actual recording operations were conducted simultaneously by the recording and shooting units. Seismometers capable of recording minute motions of the earth were pushed into the sea bottom at equally spaced intervals along the line by long poles, and interconnecting cables completed the electrical circuit to the recording instruments mounted in one of the boats. While this was going on the "shooter" and his helper aboard another boat would load the hole with the explosive.

Communication between the units was maintained by radio, not only to coordinate the procedure by voice, but to transmit the necessary time break indicating the originating time of the explosive's discharge to the nearest 1000th of a second.

After a shot had been made interpretation of the seismic data was done aboard the quarterboat, where the elapsed time of reflected energy was measured and converted to depths below sea level.

After the entire area had been surveyed, contour maps representing structural conditions at their respective depths were made and turned over to the company's geophysical department.

Then, after obtaining drilling rights on a portion of the area surveyed, Union picked its location and State-Lake Raccourci No. 1 became a wildcat test. First was the problem of staking out the location. A plat showing this operation and the manner in which it was handled appears at right.

More than a month was spent driving piling and moving the rig out to location before actual drilling operations got under way on June 6, the date the well was spudded. Everything had to be taken in by water. Loffland Brothers, drilling contractors for the test, moved their rig and equipment by boat and barge from New Iberia, and Union Producing's equipment came from Houma, a 12-hour trip over the water.

Union's original intention was to use a drilling barge, but none was available at the time so a piling foundation was substituted. The piling foundation was driven by a contract crew in 28 days. Material in it included 272 70-ft creosoted piles; 14 50-ft creosoted piles; 11 40-ft creosoted piles; 67,317 board feet of creosoted timber; 700 lb of 60d nails; 400 lb of spikes; and miscellaneous items such as cable, clamps, etc.

Drilling Operation

To save the time and expense of driving additional piling for the pipe racks, a large barge was sunk to the bottom of the lake—about 5 ft deep at the site of the well—and a utility barge was sunk to hold the fuel tanks, bunk house, mud house, etc.

The contractor used a diesel rig capable of drilling to between 14,000 and 15,000 ft, and fresh water for the motors had to be barged out to the location. Drilling mud was handled in two steel tanks, one a settling container and the other a suction tank, and salt water was used throughout.

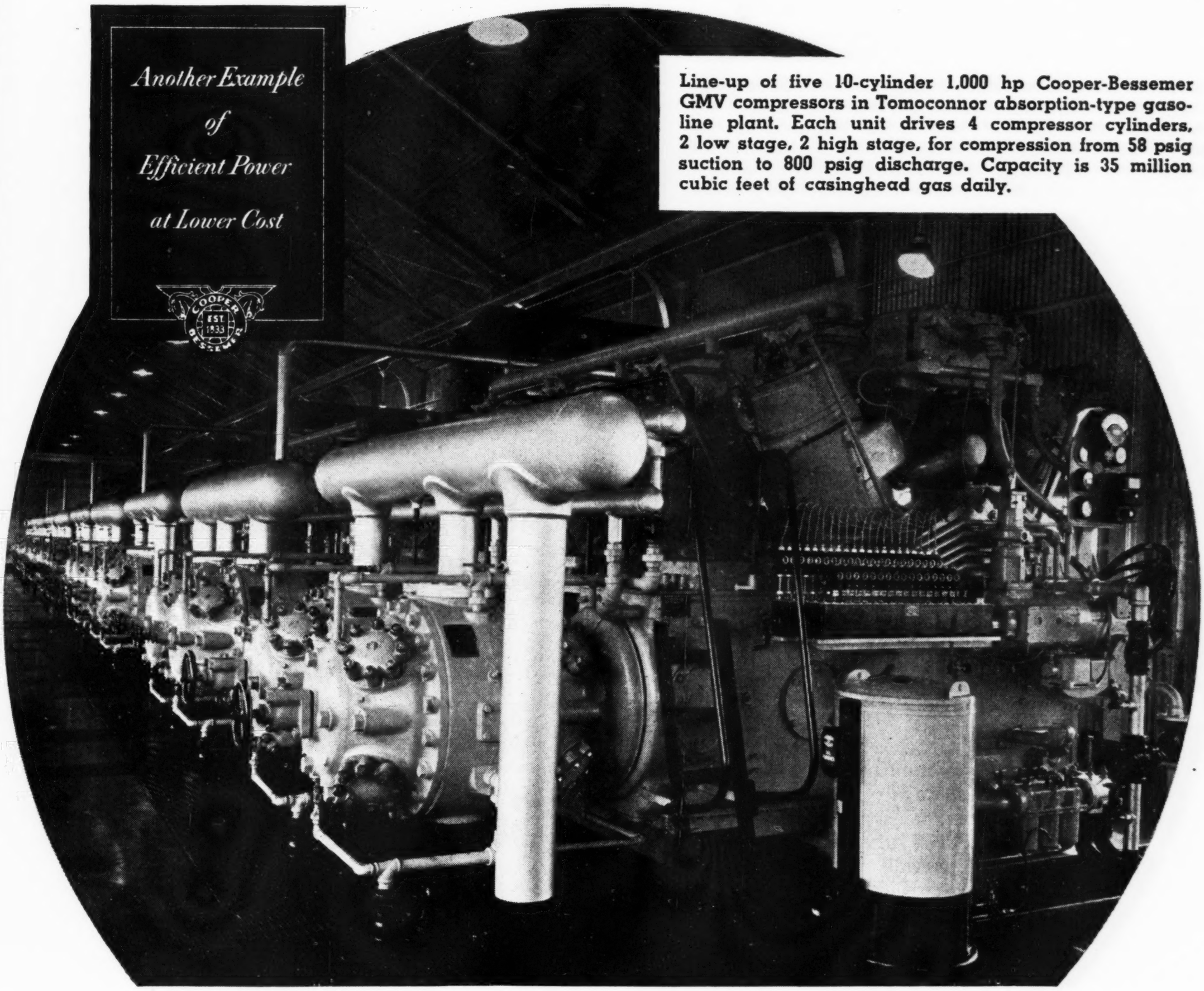
After the well was spudded on June 6, actual drilling operations went along comparatively smoothly. The rig was shut down only once because of storms, and then the only casualties were an oil drum, tool box and several sacks of mud that were washed overboard. High tide, which is the first sign of a major disturbance on the lake, all but covered the pipe atop the pipe rack on one occasion.

While the test was being drilled a close check was kept on weather conditions. There was no actual contact with the outside at the well, but the crews changed tours at 4, 12 and 8 o'clock and each group would bring the latest weather data from shore. From where most of the men stayed, they had a 10-mile auto ride to the boat landing at Leeville, La., and then a 45-minute boat trip to the rig, 12 miles away.

The well was drilled to a total depth of 13,383 ft and then plugged back to 10,466. Perforations were made between 10,430 and 10,435 ft, and on open-flow test Sept. 20, the well gaged 17,600 Mcf per day, with rock pressure of 3,941 lb. It produced 4,824 Mcf of gas and 6.82 bbls of 44.3 gravity condensate per day on 1/4-in. choke. Union released the rig on Tuesday, Sept. 20, three months and two weeks after the test was spudded.

Story and picture courtesy *United Gas Log*.

Another Example of Efficient Power at Lower Cost



Line-up of five 10-cylinder 1,000 hp Cooper-Bessemer GMV compressors in Tomoconnor absorption-type gasoline plant. Each unit drives 4 compressor cylinders, 2 low stage, 2 high stage, for compression from 58 psig suction to 800 psig discharge. Capacity is 35 million cubic feet of casinghead gas daily.

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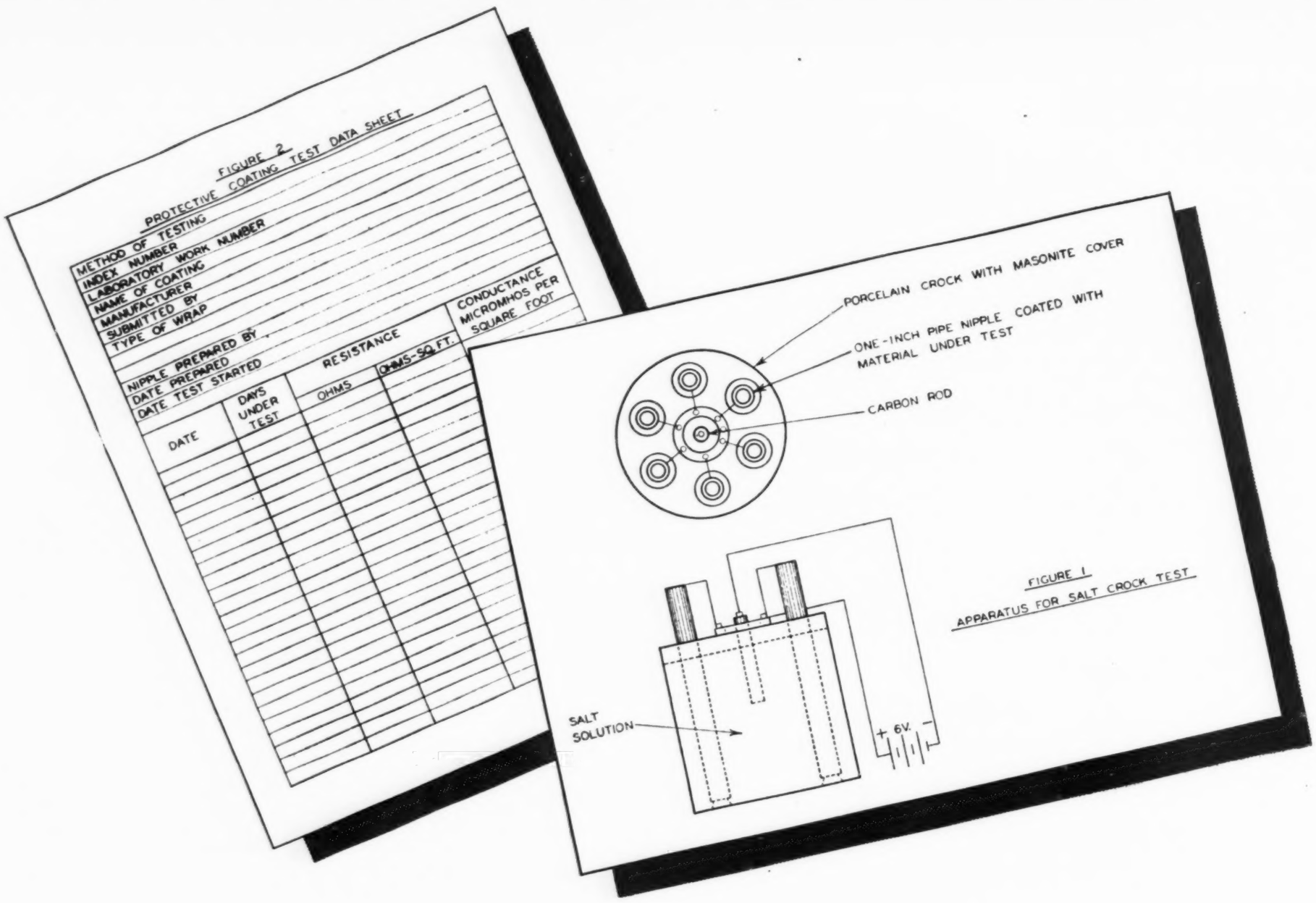


Pipe Coating Evaluation By Salt Crock Tests

By SIDNEY K. GALLY

FOR some years, the Southern California Gas Co. has used what has become known as the "salt crock test" for the preliminary evaluation of pipe coatings. This test, basically very simple, povides an inexpensive and sometimes rapid method of differentiating betweeen those materials which might be suitable as underground pipe coatings and those which are not suitable for such service, based on their resistance to water penetration.

Most products which have been developed for waterproofing or for protecting metals from corrosion—paints, plastics, waxes, gums, greases, baked finishes, bitumens and so on—in the course of time are suggested as possible protective coatings for buried pipelines. Some of these materials may offer great promise; others may be unsatisfactory. In either case it is necessary to provide something more than opinion to justify further consideration of the former or the rejection of the latter. The salt crock test is intended to supply this information. The materials which pass this test are not necessarily suitable for a practical pipe coating, however, because of such other factors as cost, difficulty of aplication, and sensitivity to physical injury.

The salt crock test is made by immersing coated pipe nipples in a standard saline solution, meanwhile continuously maintaining a six-volt potential between the nipple (normally made positive) and the solution. Failure of the coating is indicated by a decrease in the electrical resistance between the tset nipple and the solution, usually followed by a visible break in the coating with a resulting rapid corrosion of the underlying metal. Coatings which show no decrease in resistance are tentatively considered to have passed the test at the end of 60 days and definitely so after six months.

The tests are conducted in 5-gal glazed earthenware crocks, each of which can accommodate up to eight nipples. The crocks are filled to a definite height with a solution made by dissolving 1% by weight each of sodium chloride, sodium sulfate and sodium carbonate in distilled water. These salts were chosen because of their frequent occurrence in local soil waters. A masonite cover containing holes for supporting the test nipples in an upright position, a copper ring with binding posts to which the test nipples are electrically connected, and a central carbon electrode long enough to dip into the solution are provided for the crock. The apparatus is pictured in *Fig. 1.*

The test nipples are prepared from standard 1-in. steel pipe and are cut to a length of 16 in. Each nipple is shot- or sand-blasted, wire brushed, and tagged at one end with an identifying number. A copper wire is fastened to each nipple at the tagged end to provide an electrical connection. Just before they are coated, the nipples are cleaned in a vapor degreaser to remove any oil or grease which might have been acquired during handling.

Except for a distance of about 2 in. near the top, each nipple is coated over its entire length. The method of applying the coating depends upon the nature of the material. In general, the application follows whatever procedure is recommended by the manufacturer. If it is not practical to apply the coating in the laboratory, test nipples are supplied to the manufacturer who may coat them as he sees fit.

Paint-type coatings are brushed on unless spraying or dipping is specified. If there are no instructions as to the proper number of paint coats, several nipples are prepared with differing numbers of coats. The drying time of the material is observed and recorded at this time.

Hot bituminous materials are poured

Mr. Gally, engineering laboratory supervisor in the research department, Southern California Gas Co., Los Angeles, presented this paper before the technical service group conference of the Pacific Coast Gas Assn., April 28-29, in Los Angeles.

over the nipple while it is rotated slowly in a horizontal position. A coating thickness of about 1/8-in. is built up. The thickness of the coating is measured near the top of the nipple where it will not be immersed in the solution. If a primer is specified, it is brush-applied and is permitted to dry completely. If no particular primer is recommended, the red oxide primer stocked by the company is used.

Plastics are frequently submitted in the form of thin sheets which are wrapped tightly around the nipples in a spiral fashion. The overlapping edges have been sealed by heat or with a cement compatible with the plastic.

The lower end of the nipple must be sealed to prevent contact between the solution and the metal. The end of the nipple is plugged with a rubber stopper and is then dipped into molten asphalt several times until a sufficient thickness has been built up. If the material is such that it would be damaged by the asphalt, the end seal may be made with a grease. The end seal must be made with considerable care, for should it fail, it would reflect falsely on the coating being tested.

When the coating and end seal have completely hardened, the nipple is lowered into the solution through one of the holes on the crock cover.

The deterioration of the coating (if such takes place) is observed by periodically measuring the electrical resistance between the nipple and the carbon electrode. For precise resistance readings, an alternating current Wheatstone bridge should be used. However, since no great accuracy is required for this test, an ordinary direct current ohmmeter with a maximum reading of 20 megohms facilitates making readings.

Before the nipple is connected to the battery, an initial coating resistance reading is made. If the coating is continuous, the resistance should be very high.

The wires from the tops of the test nipples are connected to the binding posts on the copper ring mounted on the masonite cover. The ring is in turn connected to the positive terminal of a six-volt storage battery. The negative terminal of the battery is connected to the carbon electrode. Any number of crocks may be wired in parallel with one battery since the current drain is negligible until a coating is penetrated.

For the first week following the start of a test, the resistance of the coating is measured daily (the battery of course being disconnected while the ohmmeter is attached). The readings are then taken weekly up to a month and monthly thereafter. The resistance readings are recorded on the data sheet shown in *Fig. 2*. One such sheet is maintained for each nipple under test. The resistance readings are converted to conductance-per-unit-area so that they may be compared with the API-AGA criterion of coating failure of 40 micromhos per square foot. A test is terminated when the coating conductance rises above this value.

It is recognized that making the test nipple positive prolongs the life of some coatings because of the electro-osmosis effect which retards water penetration into the coating. It is believed that this is of no significance with bituminus coatings but may be quite important with some other types. A modification of the test is being considered where duplicate test nipples will be used, one being maintained six volts positive to the solution, the other, six volts negative.

It has been pointed out that the salt solution is less injurious to many coatings than is soil. However, since this is intended to be an elimination test and not a simulation of underground conditions, it is not believed that the complication of using soil instead of a salt solution is justified.

There are several pipe coatings still under test which were placed in the crocks seven years ago and still do not have a measurable conductance.

B & W Announces

NEW TUBING DEVELOPMENT

TUBING designed to withstand pressures as high as 10,300 psi at 1000° F is included in the piping system produced by the Babcock & Wilcox Tube Co. (Beaver Falls, Pa.) for the coal-to-oil demonstration plants opened recently by the U. S. Bureau of Mines at Louisiana, Mo.

The two demonstration plants, which are located about 100 miles north of the city of St. Louis on the Mississippi river, will operate two different methods for the conversion of coal and lignite into a full range of high-quality synthetic liquid fuels. Direct hydrogenation and gas synthesis will both be employed to produce the fuel. Purpose of the plant is to test and prove American coals, equipment, and processing methods for what is expected to become a new synthetic liquid fuel industry.

The coal-to-oil project operates on the principle that gasoline is a mixture of hydrocarbons, and that coal is a mixture of highly complex carbon compounds containing about half as much hydrogen as gasoline. The purpose of hydrogenation is to put necessary amounts of additional hydrogen into combination with coal to convert it into gasoline.

The complete process involves high temperatures and unusually high operating pressures — which called for an alloy tubing resistant to corrosion under these conditions and efficient under the same conditions. Babcock & Wilcox-designed tubing of several types was recommended and ultimately chosen for valves and fittings and the piping system of the paste preheater, splitting-phase unit, and heat exchangers.

Tubing used includes sizes from 1/32-in. to 6⅝-in. outside diameters and .145-in. to 1.169-in. in wall thickness. Hot finished or cold drawn tubing in low carbon, AISI 1040, AISI 4130, B&W Croloys 5, 9M, and 16-13-3 (Type 316) grades, are included in the various installations in the two plants. This is the first time that Croloys 16-13-3 and 9 have been used in equipment for the coal hydrogenation process.

Special operations such as polishing the inside diameter, special ends, and center-welding for length were performed in completing the stringent requirements for the tubing to be used in the plants. One lot of Croloy 9 was center-welded for length, and a special end made from bored billet stock was fusion-welded to one end of the long tube. Special physical properties were achieved by heat treating.

The most striking factor in the lot of tubing for the job was the size of the wall compared with the outside diameter of the heavy-walled Croloy 16-13-3 used in the high-pressure elevated-temperature part of the installation. This tubing, 4 25/32-in. outside diameter by 1.169-in. wall thickness with a polished inside diameter, is operating at the unusual combination of 10,300 psi pressure and about 1000°F. The extra-thick walls are necessary to resist the extremes of pressure and temperature.

Streams conveyed in pipelines of the demonstration plants consist essentially of a mixture of hydrogen, light hydrocarbon gases, H_2S, nitrogen, oils, and coal paste, with temperatures up to 1000°F. Croloy 16-13-3 is used in all instances of this high temperature range. A chromium-nickel-molybdenum austenitic stainless steel, it is efficient for this type of operation because of very high creep strength. Requirements for the hydrogenation process call for a minimum room temperature tensile strength of 75,000 psi, with creep strength at 1000°F of not less than 23,000 psi to produce 1% elongation in 10,000 hours.

MICHIGAN LINE IN

Hugoton link completed six months early

A link between Michigan and Wisconsin on the one end and Hugoton gas field on the other was completed Oct. 28 when Michigan-Wisconsin Pipe Line Co. put into operation its 1200-mile line. The new facilities will quadruple the supply of natural gas in Michigan and will enable Wisconsin to receive natural gas for the first time.

The line was completed six months ahead of schedule and at a cost substantially lower than the $88 million originally estimated. Stretching from Hansford county, Texas, to the Austin gas storage field north of Grand Rapids, Mich., and to Green Bay, Wis., the line will help to meet heavily expanding needs of present and prospective customers.

With an original capacity of 155 MMcf the line will serve Detroit, Ypsilanti, Ann Arbor, Grand Rapids, Muskegon, Greenville, Belding, and Mount Pleasant, Mich., the Milwaukee area, and various unaffiliated utilities including Madison (Wis.) Gas & Electric Co., St. Joseph (Mo.) Light & Power Co., Wisconsin Power & Light Co., and Wisconsin Public Service Corp.

By storing gas in off-peak months in the Austin field, which can be tapped at the rate of 320 MMcf per day in the winter, the company will be able to boost daily delivery to an estimated 375 MMcf. Through use of the storage field, the line will be able to operate at full capacity every day of the year.

Skyrocketing demand in the territory served by Michigan Consolidated Gas Co., Detroit, has prompted Michigan-Wisconsin to request FPC approval for additional capacity. Since the utility lifted restrictions last August on the addition of new space heating customers, 90,000 applications have been received, representing a gain of more than 82% over the 109,522 space heating customers at the end of 1948. About half of these had already been connected for service when the line was dedicated.

Michigan-Wisconsin also is receiving deliveries of 125 MMcf per day from Panhandle Eastern Pipe Line Co. under a contract running through 1951. Through further increase in compressor capacity and lease of an additional storage field in Michigan, Michigan-Wisconsin expects the line to reach a carry of 650 MMcf.

Canadian Gas Export Hearings Under Way

A final decision may be forthcoming soon on the question of whether and how soon Canadian gas will be imported into the Pacific Northwest area of the United States.

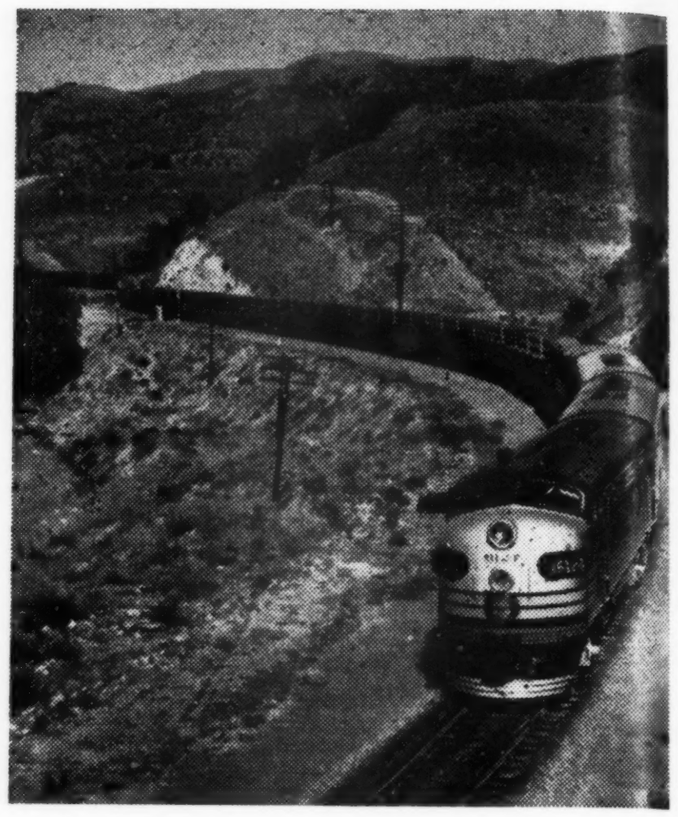
Hearings on two applications for export permits were due to get under way Nov. 28 and Dec. 12 in Calgary. The petroleum and natural gas conservation board of the province of Alberta has jurisdiction over these applications and until it issues an order, the federal board of transportation at Ottawa is holding up approval of the two pipeline construction applications.

Northwest Natural Gas Co., first of the applicants, seeks to build a line to Spokane and Seattle and back across the border to Vancouver, B. C. Westcoast Transmission Co. would build a line directly to Vancouver and then to Seattle and southward as far as northern California.

El Paso Serves White Sands

The U. S. Army's White Sands proving ground in Dona Ana county, New Mexico, will start receiving gas from El Paso Natural Gas Co. as a result of a temporary authorization granted by the FPC in October.

Delivery of 1.5 MMcf per day will be made to the Sacramento Corp., Alamogordo, for transport to the Army installation.



A trainload of pipe moves eastward from Oakland, Calif., bound for East Texas and Louisiana. The 60-car train contains enough 20-in. pipe for a 9½-mile section Texas Eastern Transmission Corp. is laying. Basalt Rock fabricated the pipe at Napa, Calif., from Kaiser Steel plate. Kaiser is also supplying plate for Transcontinental's Texas-New York line, now under way.

San Diego Opens Takeoff From Texas-California Line

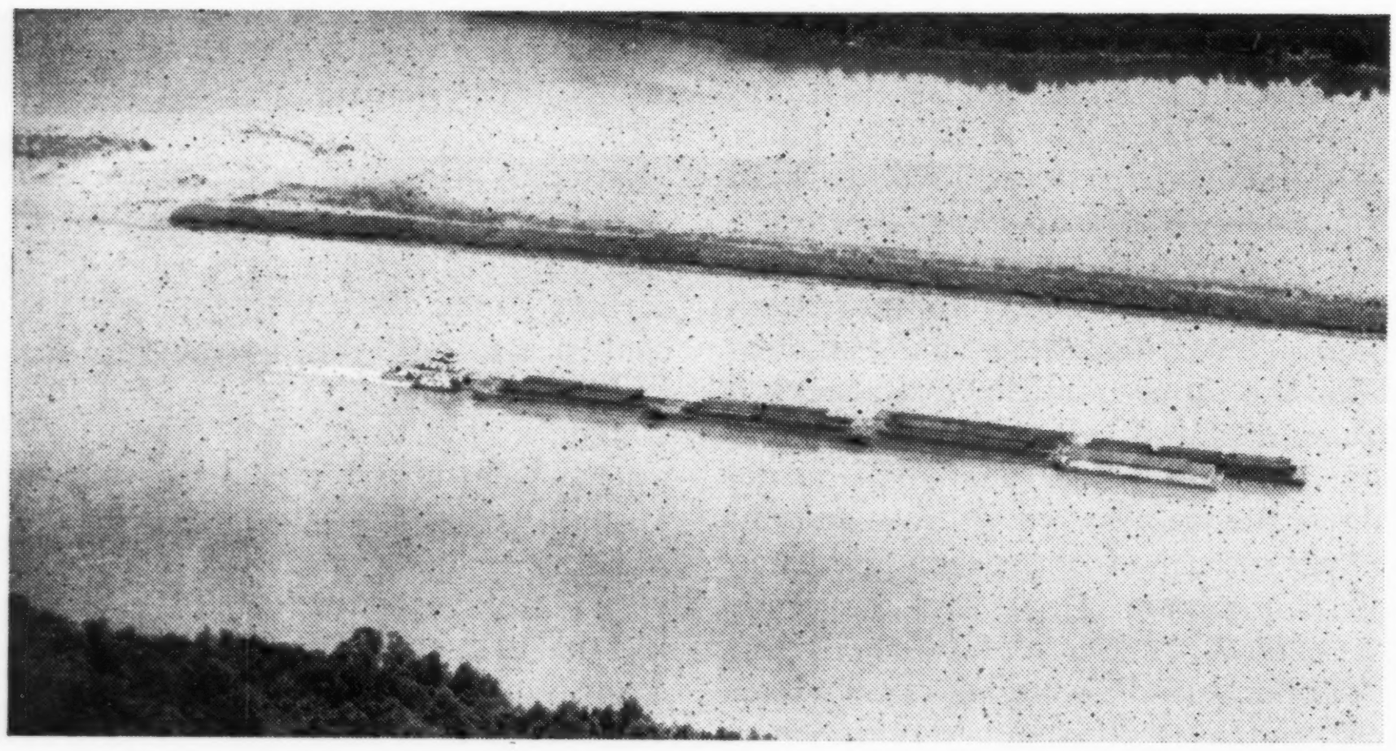
Completion of the new 85-mile Moreno (Calif)-to-San Diego natural gas transmission pipeline was dedicated Nov. 25 in a ceremony held by the San Diego Gas & Electric Co. at the San Diego terminus of the line. Climax of the ceremony was the opening of a huge control valve that released the flow of this much-needed additional supply of natural gas to the San Diego area.

The commemoration program followed a buffet luncheon attended by representatives of the utility and their invited guests. President A. E. Holloway acted as master of ceremonies. L. M. Klauber, chairman of the board, told the assembled guests the story of the pipeline and its importance to growing San Diego county. Then Mr. Holloway called upon Harley E. Knox, mayor of San Diego, to open the valve controlling the flow of gas, thus officially putting the line into operation.

Built at a cost of $5 million, the 16-in. pipeline is capable of delivering 40 MMcf of gas daily. This more than doubles the supply of natural gas previously available to San Diego through the company's Huntington Beach pipeline. With the completion of the new transmission line, San Diego is assured of an adequate supply of natural gas for years to come.

The company has also completed the installation of a propane-air plant which stands in readiness to operate in any natural gas shortage emergency. The major component of the plant is a farm of 36 tanks with a total propane storage capacity of 1 million gal, which can be converted into gas at the rate of 70 cu ft per gal.

(For photo of the line, see Pipeline Section cover. For technical details of the line see GAS, May 1949, p. 108; of the propane-air plant, GAS, October 1949, p. 54.)



If the weather is good, East Tennessee Natural Gas Co. will have its line supplying the atomic energy installation at Oak Ridge, Tenn., in the ground Dec. 2. In this photo, four barge-loads of pipe move along the TVA dams on the Tennessee river.

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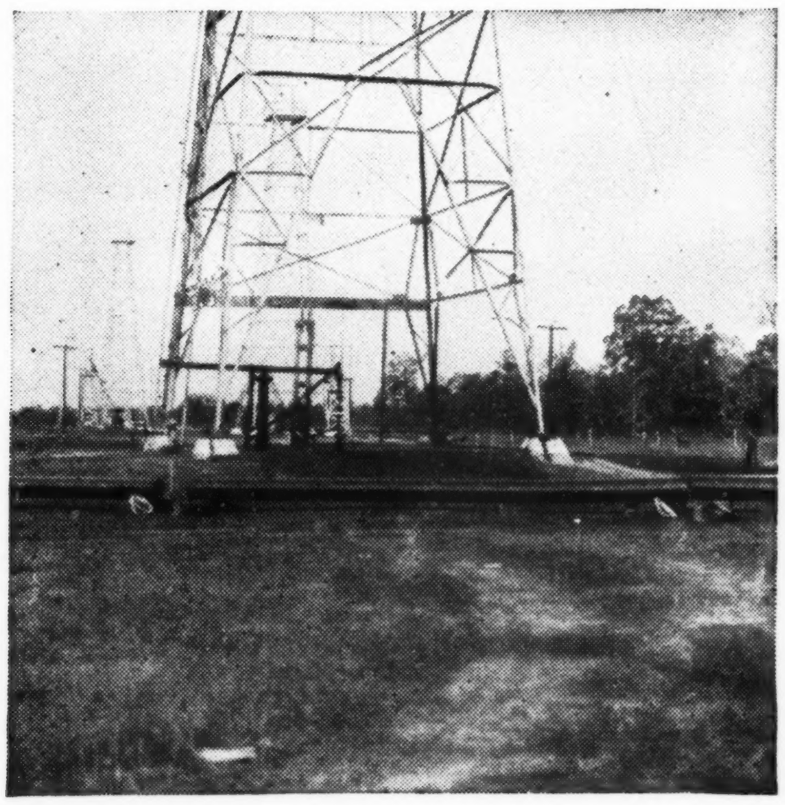

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Two Pipeline Firms Appeal Kansas Wellhead Price Fix

Appeals from a decision upholding the right of the Kansas Corporation Commission to fix the wellhead price of natural gas were filed Nov. 9 in the Kansas Supreme Court by Northern Natural Gas Co. and the Kansas-Nebraska Natural Gas Co.

The appeal was from a ruling made last September by Judge Ray H. Calihan of the Finney county district court.

At that time Judge Calihan upheld as "lawful and reasonable" an interim KCC order fixing a minimum price of 8 cents per Mcf for gas taken from the Kansas sector of Hugoton field.

The challenge to the KCC order was originated in district court by Northern Natural, Kansas-Nebraska Natural and the Panhandle Eastern Pipe Line Co.

The commission contends "the placing of a minimum value at the wellhead is simply a tool of conservation," admitting it has no price fixing power as such.

Golden Trend Flare Gas Utilization System Dedicated

A system including gasoline and gas processing plants, and pipelines embracing Garvin and McClain counties in the "Golden Trend" area of Oklahoma and designed to halt flaring and wasting of natural gas in six oil- and gas-producing areas, was dedicated at Maysville, Okla., on Oct. 26.

Gov. Roy Turner of Oklahoma lauded the action of the five companies which united to construct the plant system—Carter Oil, Cities Service Oil, J. E. Crosbie Inc., The Texas Co., and Warren Petroleum Co. The latter company will operate the plants, which are all connected by a pipeline system.

Plants are at Antioch, Maysville, and Lindsay. The Maysville plant will do all of the stripping of liquids from the gas.

The gas is gathered from about 500 wells in Antioch, Elmore, Lindsay, New Hope, Maysville, and Wayne areas. The three plants are processing 85 MMcf of gas a day and recovering 225,000 gal. of liquid products.

In a similar plant at Velma, Stephens county, the Skelly Oil Co. is processing the gas it produces as well as gas purchased from other producers in the area.

The Oklahoma Natural Gas Co. will purchase part of the residue natural gas from all four of these plants and provide a market for it by carrying it through three large transmission lines to the company's present transmission system. Thus the operating oil companies in the area and the Oklahoma Natural Gas Co. are combining their facilities to utilize completely the natural resources contained in the Golden Trend area.

Oklahoma Natural Gas Co. completed this year construction of the three lines (see *GAS,* May 1949, p. 110) which will carry the gas from this new producing area into its transmission system.

Tennesee Gas Transmission Co., Houston, is racing along with its main-line looping program, with many sections already complete. Photo shows four Caterpillar tractors with sidebooms laying a mile a day. During the summer, work was done from 4 a.m. to 11 a.m. to allow wrinkles to be laid and to avoid slipping of wrapping because of heat.

Montana-Dakota Ordered To Perform Common Carrier Duty

A dispute over whether a 1½-mile, 1½-in. lateral line is a distribution or a transmission pipeline was tentatively settled recently by the FPC when it decided on the latter designation and ordered Montana-Dakota Utilities Co., Minneapolis, to perform common carrier natural gas transmission service through it.

Beneficiary of the initial decision was Mondakota Gas Co., Billings, Mont. As an operator of a system extending across U.S. public lands, Montana-Dakota is required by act of Congress to perform common carrier service. In its failure to accept for transmission through the tiny line up to 500 Mcf daily from a Mondakota line to the Eastern Clay Products Co. plant near Belle Fourche, S. Dak., Montana-Dakota was charged with violating its common carrier status.

Montana-Dakota held that in this instance service was desired from a distribution line not covered by its tariff. Examiner M. G. Baron decided otherwise. The line in question extends from Montana-Dakota's main transmission line to a valve near the Eastern Clay Products plant.

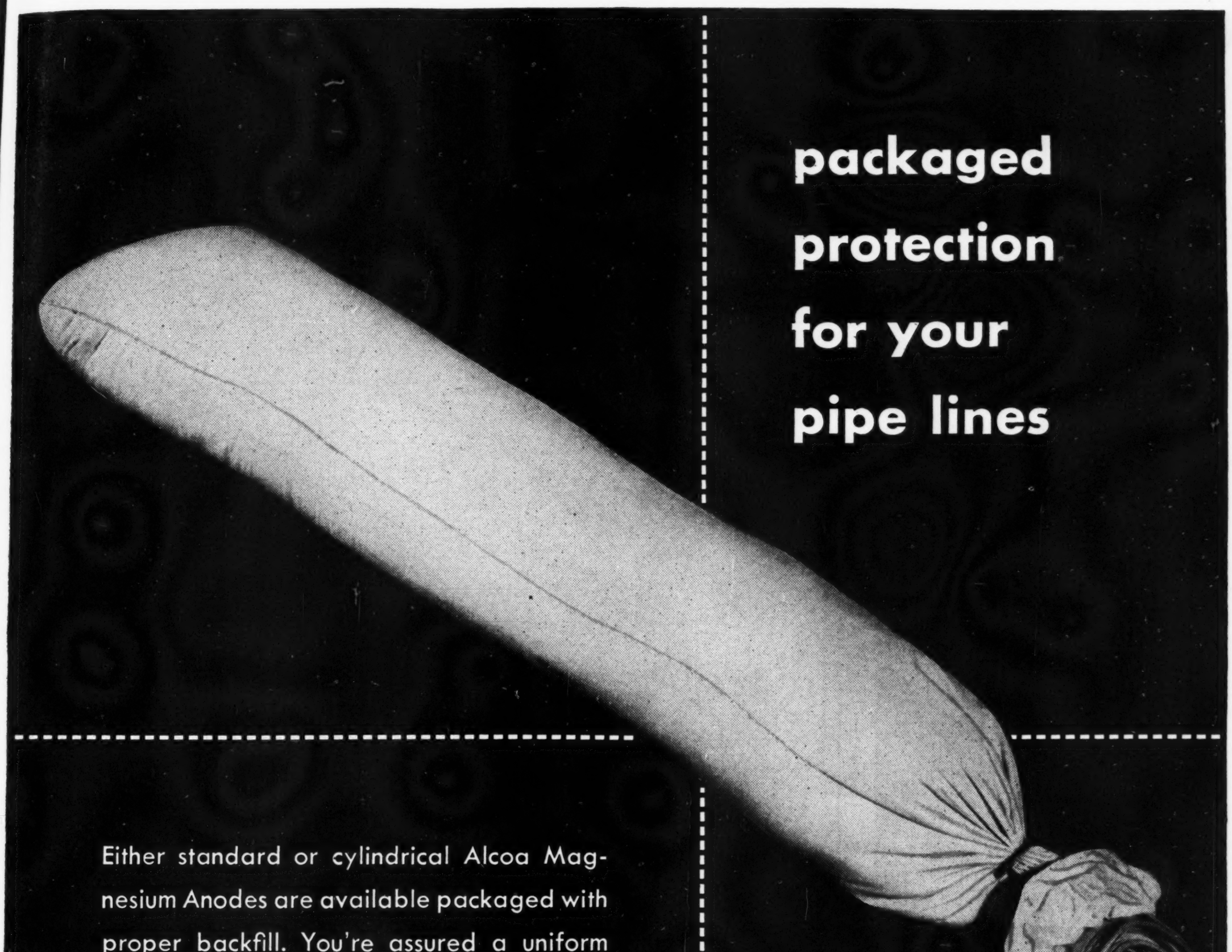
Texas Eastern Bids for Line to New England

Texas Eastern Transmission Corp., Houston, last month formally put in its bid to take gas to the New England area when it filed application with FPC for a 200-MMcf capacity line. The petition was an amendment to a previous application made March 10, 1948, which had asked for extensions to the Big and Little Inch pipelines which the company operates. If approved, the line would be put into operation by 1951.

The new line would loop with 30-in. pipe the existing Inch lines from Lebanon, Ohio, to Connellsville, Pa., and thence to Concord, N. H., serving cities in Connecticut, Massachusetts and Rhode Island on the way. The existing Inch lines from Connellsville would

Speeding Shutoffs

Considerable savings in both labor and material are claimed for a new method of making quick shutoffs when converting to natural gas. Instead of the conventional method employing valves, this procedure involves cutting the pipe, inserting a thin disc of 18-gage steel, and applying a Skinner Seal Split Coupling Clamp. Photos above show these three steps. When shutoff is completed, line may be reopened quickly by loosening the clamp, removing disc, and resealing clamp. Details are obtainable from M. B. Skinner Co., South Bend, Ind.



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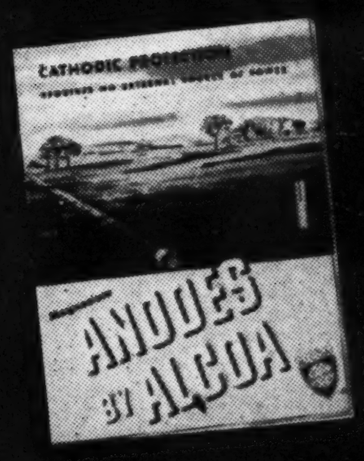

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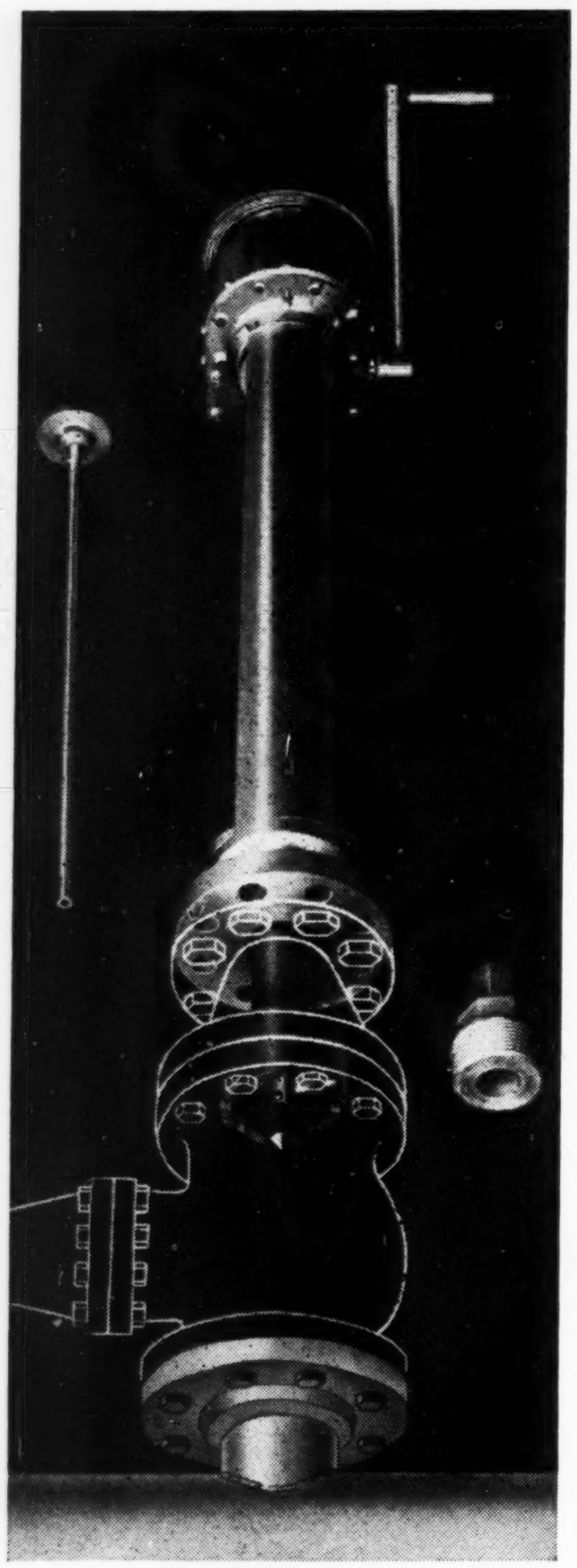

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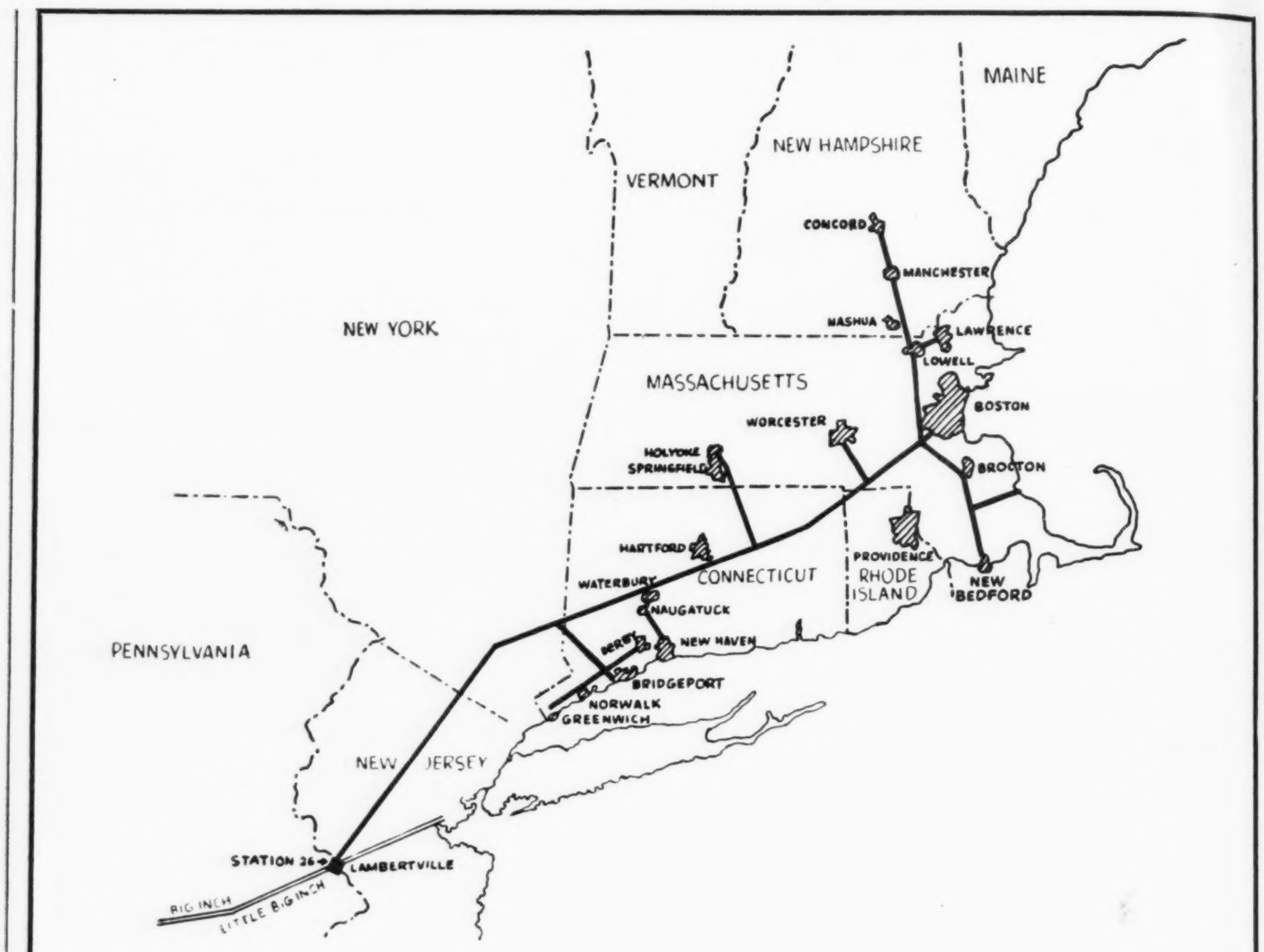


Route of Texas Eastern's proposed New England line. Map omits name "Plymouth" just below "Brockton." Also, line runs from Worcester takeoff to Providence.

be used for transportation of additional gas as far as Lambertville, N. J. An additional 49,200 compressor horsepower would be installed on the system.

Texas Eastern's daily sales capacity, now authorized at 740 MMcf, would be increased to 940 MMcf if the application is granted. New England cities which would be served include: Greenwich, Bridgeport, Norwalk, Derby, New Haven, Hartford, Waterbury and Naugatuck, Conn.; Springfield, Holyoke, Worcester, Boston, New Bedford, Plymouth, Brockton, Lowell and Lawrence, Mass.; and Manchester, Concord and Nashua, N. H.

United Gas Will Hook System To Four More Fields

United Gas Pipe Line Co., Shreveport, La., will build a 26-mile, 112-MMcf capacity pipeline to connect four gas fields in Cameron parish, La., with the company's system in east Texas.

The additional gas will be made available to the Beaumont-Port Arthur area as a result of the FPC giving its approval to the project late in October. United will buy the gas from Magnolia Petroleum Co. According to United, there is at present no outlet for the gas produced in the four fields.

Cost is estimated at $1.8 million.

Newsnotes

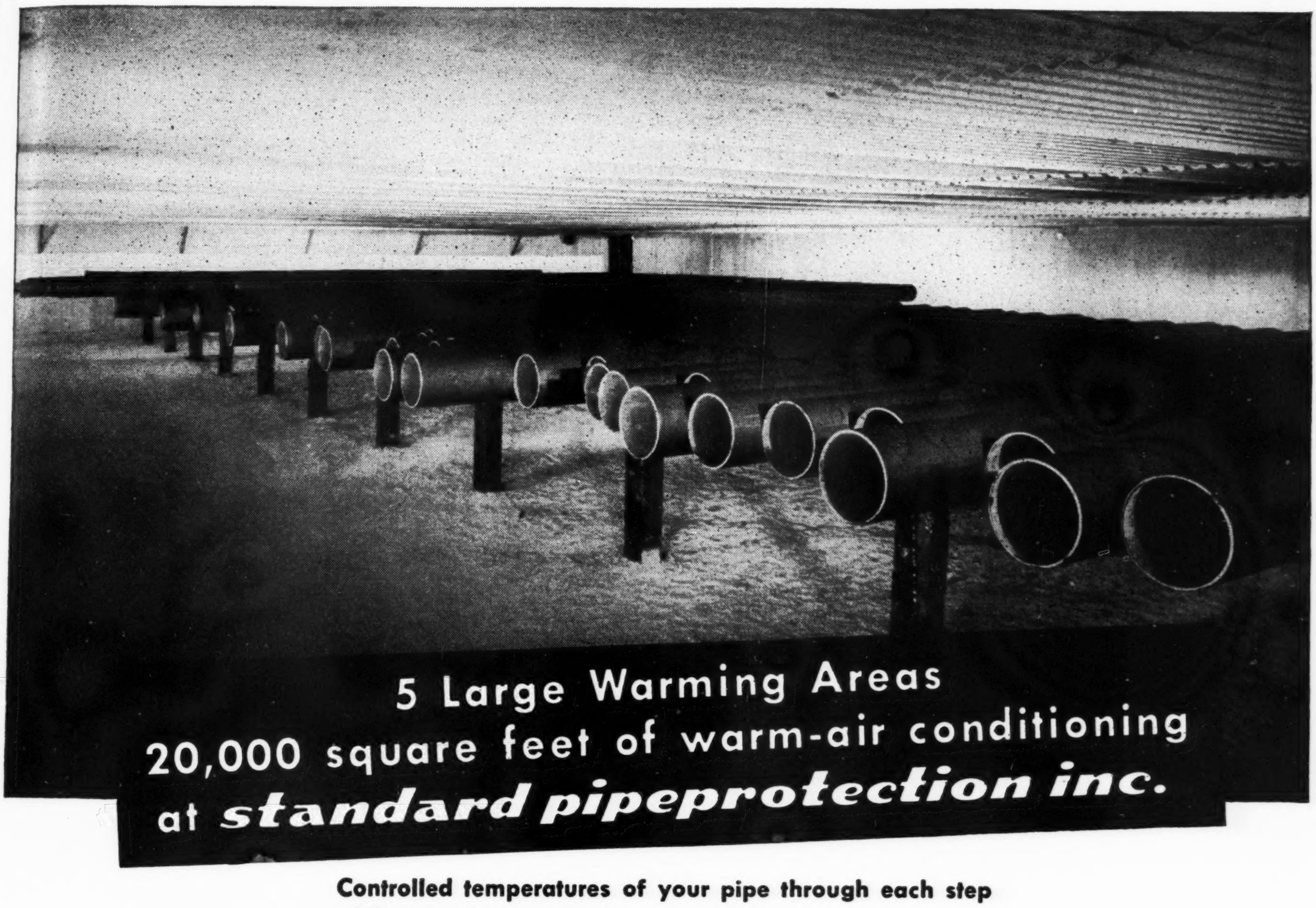
Lone Star Producing Co. has completed its first oil well in Scurry county, Texas, and the completion test rated the well at 409 bbl of oil and 324 Mcf of gas in 24 hours. The company owns other leases in the county and is under way on the drilling of a second well . . . The 170-mile natural gas pipeline to the atomic energy plant at Oak Ridge, Tenn. will be completed in December at a cost of $10 million, Ebasco Services Inc. officials said. Ebasco, designer of the 22-in. line, is supervising construction, which began at Greenbriar, Tenn. . . . Virginia Gas Transmission Corp., denying charges that it has not sufficient supplies of natural gas to service certain cities in Virginia, asked last month that a 60-day recess in the FPC hearing be set aside, since it "might prove costly to the subject cities." Piedmont Natural Gas Corp., competing with Virginia Gas for authorization to serve the area, had asked for the recess . . . Panhandle Eastern has revealed that it expects its current construction program to boost company capacity to 198 MMcf of natural gas, and that it could operate at 100% capacity for 25 years with present known reserves.

Pipeline Progress

COAST COUNTIES GAS & ELECTRIC CO., Santa Cruz, Calif., was scheduled to complete one line late in November and to start another Nov. 15. The first was 27,700 ft of 10¾-in. and 21,400 ft of 8⅝-in. high pressure line from Clyde to Walnut Creek. The second was 45,000 ft of 10¾-in. line from Watsonville to Rob Roy Junction, looping an existing 8⅝-in. line. Completion is anticipated Dec. 15 on the latter. Martin Brothers, Concord, and MGM Co., Concord, are respective contractors.

PHILADELPHIA ELECTRIC CO. has completed 3.9 miles of 12-in. steel main from Chester, Pa., to the Delaware-Pennsylvania state line. The 18 miles of 12- and 8-in. cast iron pipe from Rydal, Pa., to Penndel and Eddington, Pa., was scheduled to be in Dec. 1. (See October *GAS*, p. 119.)

ARKANSAS LOUISIANA GAS CO., Shreveport, has been hampered by the steel strike and slow pipe deliveries in trying to com-



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plete 163 miles of 20-in. line from Waskom, Texas, to Malvern, Ark. Sections 1 and 2 from Waskom to Magnolia, Ark., are contracted to Anderson Brothers and sections 3 and 4, from Magnolia to Malvern, to Latex. Omaha Dredge & Dock Co. is working on Ouachita and Red river submerged crossings. Sixty miles of the Latex stretch had been completed in early November.

TENNESSEE GAS TRANSMISSION CO., Houston, reports progress on seven spreads along its 30-in. main line loop, 26-in. loop and 12- and 16-in. laterals. Through October the company laid 15 miles from near Holly Springs, Miss., to near the Mississippi - Tennessee state line, completing the spread. Anderson Brothers laid approximately 27 miles to complete the spread from near Clay City, Ky., to Union City, Ky. H. C. Price Co., working on a 30-in. loop near the Mississippi-Tennessee state line to near Selmer, Tenn., made 22 miles in October and was scheduled to complete the job in November. Morrison Construction Co., working on a 30-in. loop from near White Bluff, Tenn., to near Joelton, Tenn., made seven miles and was due to finish the job before Dec. 1. Anderson Brothers, on a 26-in. loop from near Hilda, Ky., to Clay City, Ky., made 13 miles and was scheduled to complete the job before Dec. 1. Massey Construction Co., building a 12-in. lateral from near Eagle Lake, Texas, to near Columbus, Texas, made 12 miles and was reported finished with the job in November. Sheppard & Geiger, laying a 16-in. lateral from near Bay City to near Lissie, Texas, made five miles. This job will be finished late in December. In addition, a 4- and 6-in. line to the city of Morehead, Ky., was being completed by Modern Welding Co. Inc., Owensboro, Ky. Delivery of pipe was holding up a river crossing which Latex was building for two 16-in. lines across the Mississippi south of the Greenville, Miss., bridge.

TRANSCONTINENTAL GAS PIPE LINE CORP., Houston, last month had completed one-sixth of its 1840-mile Texas-to-New York line. The steel strike failed to interfere with progress and good fall weather had permitted steady work on the line. Completion of the entire line is expected by October 1950. As of Oct. 31, 373.7 miles were in the ground and 557 miles of pipe had been received from the fabricator. Right-of-way clearing for the 1949 construction program of approximately 600 miles was virtually complete. The Coosa aerial crossing was 12% complete; Tombigbee, 93% complete; Leaf river, 90% complete, and Pearl, 20% complete. Right-of-way acquisition was close to the 1000-mile mark. Work on the meter station pier on the Hudson river was due to start with contracts to be let on Hudson, Passaic, and Hackensack river crossings. A dump across the Jersey Meadows, in which the main line between Newark and Ridgfield is to be laid, is under construction. Midwestern Constructors Inc., Tulsa, reported completion of section 4 of a 216-mile stretch from Demopolis, Ala., to Newnan, Ga., under Bill Whilhite. Section 5 was 40% complete.

ALABAMA-TENNESSEE NATURAL GAS CO., Florence, Ala., expects to complete the 80-mile section of 10-in. pipe from Selmer, Tenn., to Muscle Shoals, Ala., Dec. 15. Twenty-three miles had been laid in October. This is part of a 155-mile line from Selmer to Huntsville, Ala., to connect with Tennessee Gas Transmission's 24-in. line. Lehman, Hoge & Scott are contractors.

MONTANA-DAKOTA UTILITIES CO., Minneapolis, expected to complete in mid-November the laying of 21 miles of 6⅝-in. line from Utopia gas field to Telstad compressor station. One spread was working under Utility Builders Inc. and Nilson Smith Construction Co., Great Falls, Mont. Work began late in October.

SOUTHERN CALIFORNIA GAS CO., Los Angeles, expected to complete Nov. 15 a 17-mile stretch of 20-in. line looping the 18-in. Ventura to San Fernando line with Signal Pipe Line Construction Co. as contractor. One spread was working northwest of Calabas.

EL PASO NATURAL GAS CO., reported progress on its 30-in. loop from Jal, N. M., 600 miles to Salome, Ariz.; 30-in. crossover from Salome to Topock, Ariz., of 120 miles; a 20-in. line from Kermit, Texas, running 27 miles to Goldsmith, Texas, and 10 miles of smaller lines near Phoenix. Spread 1 out of Willcox, Ariz., had laid approximately 30 miles in 30 days but was due to be down because of lack of pipe about Nov. 15. Spread 2 out of Jal laid nine miles of line near Levelland, Texas, and eight miles in Fullerton field in west Texas and was to start on the 20-in. Goldsmith line Nov. 25 and eight miles to complete the 20-in. Fullerton loop about Dec. 10. Spread 3 had completed the Alamogordo line and moved to Casa Grande and was down due to lack of pipe.

TEXAS EASTERN TRANSMISSION CORP., Shreveport, made 15 miles on its 37-mile loop from Castor to Lisbon, La. (*GAS*, November, p. 104.)

TEXAS GAS TRANSMISSION CORP., Memphis, Tenn., on its main line from Carthage, Texas, to Middletown, Ohio, was delayed by adverse weather conditions and pipe shortages during October. Half the working days were lost as a result. All right-of-way has been secured from Carthage to the Ohio state line with the exception of two small portions. In Ohio 15½ miles were outstanding. Forty-six miles of 20- and 26-in. line was laid in October, bringing to 585 the total mileage in the ground. Eighty-two per cent of the 26-in. line had been completed. All 26-in. pipe had been delivered or was in transit. Three compressor stations will be finished late in December, two more in January, and the sixth by April 1, 1950. Red river crossings being built by Latex were reported 50% complete. These are near Curtis, La.

PANHANDLE EASTERN PIPE LINE CO., Kansas City, Mo., had Midwestern Constructors at work on additions to the Sunray, Texas, compressor station under Supt. J. A. Bard. The job was 90% complete in early November.

MICHIGAN CONSOLIDATED GAS CO., Grand Rapids, Mich., was to complete by mid-November six miles of 22-in. line from Jenison to Grand Rapids, Mich., to supply that city from the Michigan-Wisconsin pipeline. The job was started Oct. 15 under Somerville Construction Co., Ada, Mich., with Pat Mask as superintendent.

AMERICAN REPUBLICS CORP. started work in early November on 22 miles of gas and crude oil lines near Silsbee, Texas. Latex had the contract with O. R. Mitchell spread superintendent.

MISSISSIPPI RIVER FUEL CORP., St. Louis, has Sheehan Pipe Line Construction Co. at work on 10 miles of 20- and 24-in. line in East St. Louis, Ill.

EAST TENNESSEE NATURAL GAS CO., Nashville, Tenn., expected to complete its 172-mile 22-in. line from Greenbrier, Tenn., to Oak Ridge to supply the atomic energy commission on Dec. 2. Last month the company had one spread near Cookville, Tenn., one at Wartburg, and another inside the government reservation at Oak Ridge. Omar Construction Co., Nashville, Harrison Construction Co., and Wright-Boyle Construction Co. were doing the job.

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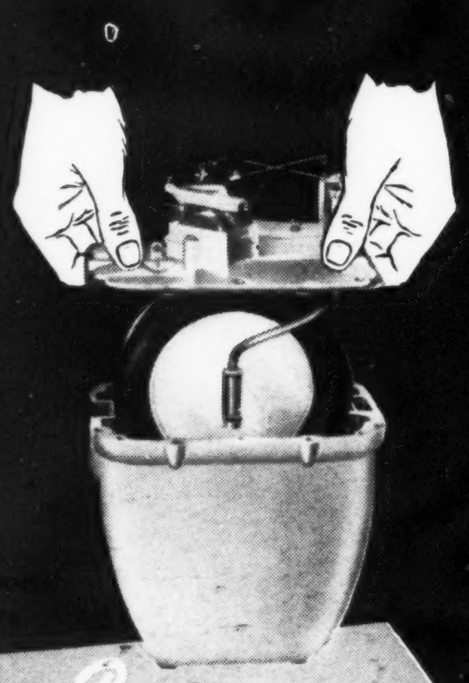
AMPLE CAPACITY*

INTER-CHANGEABLE WITH ALL MAKES



Service Case

You need only a screw driver to remove the valve plate assembly from the body. This assembly can then be replaced with a factory fresh unit. You have the option of returning worn internal units or complete meters to the factory for economical repairs.

Everything you could ask for in a meter has been wrapped up in the smooth aluminum alloy housing of the No. 00 Rockwell-Emco meter. It's light yet strong—easy for your men to handle and install, economical to ship. Up to 90 percent of your domestic services are within its capacity range*. Over the years, the durability and service accessibility of these meters will save money for your company. *Get full facts now! Write for bulletin 1036.*

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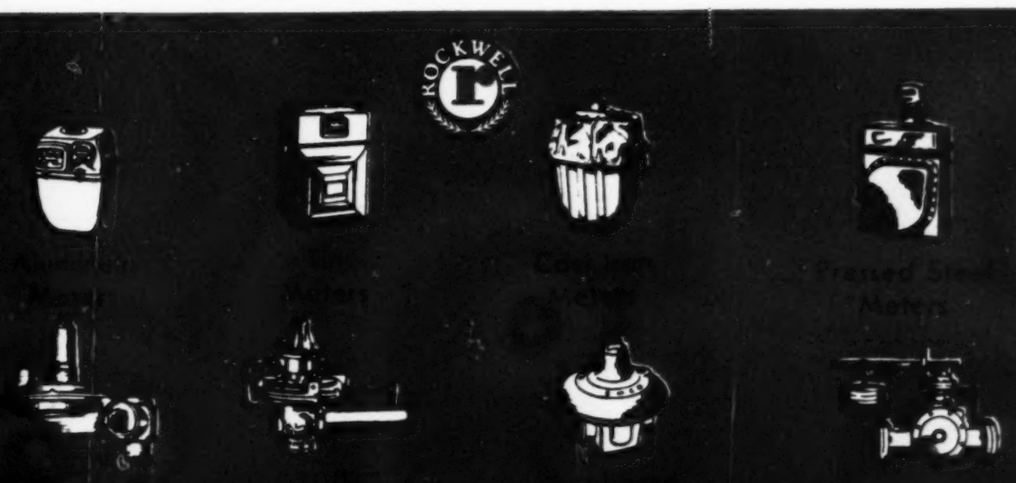

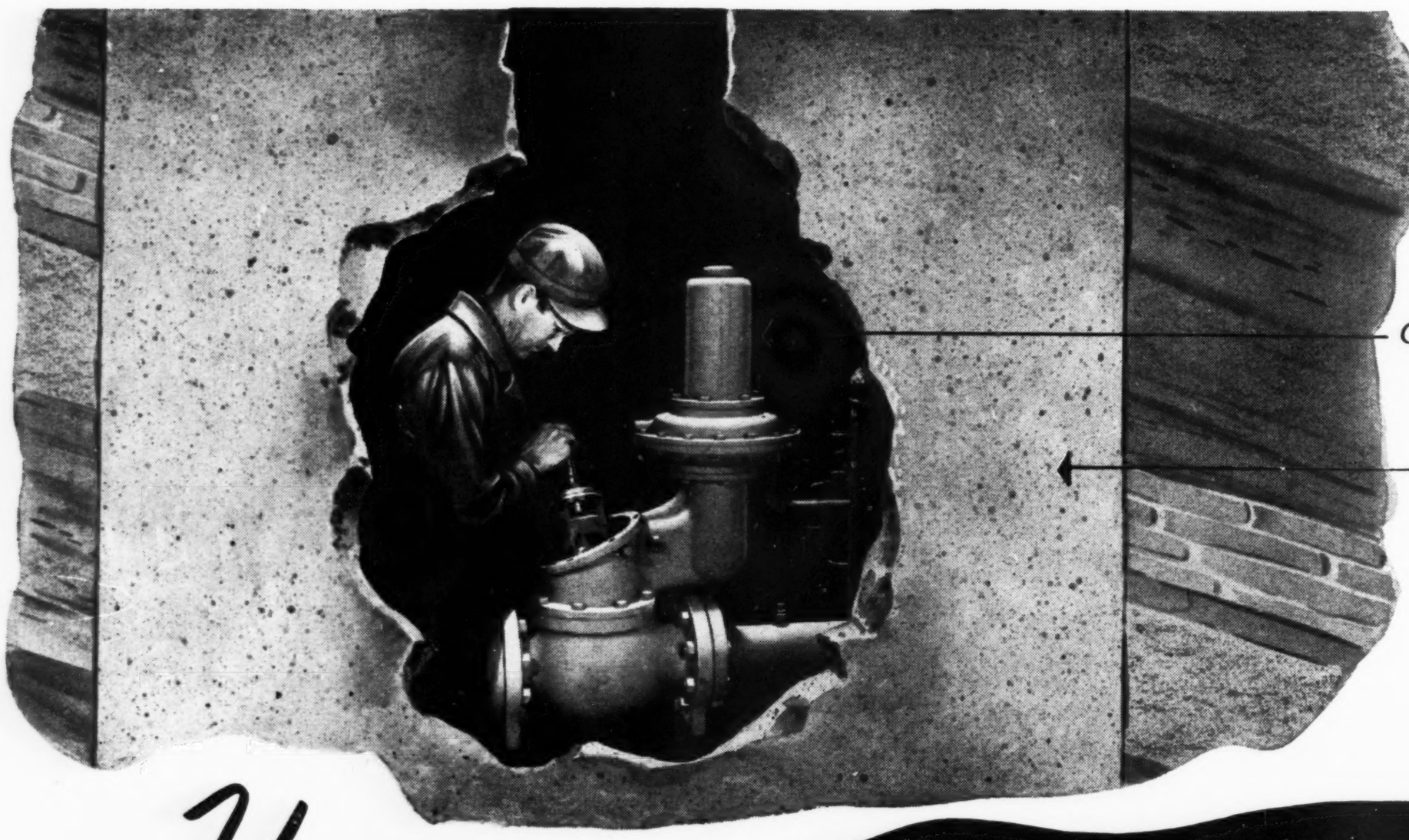

CBV—Offset Model, Spring Loaded

Gas Distribution Regulator Vault

Reliance C.B.V. Regulators FOR DISTRIBUTION

EASY TO SERVICE

All parts of the Offset Model "C.B.V." Regulator are readily accessible. Changeovers to handle different gas pressures and service of the valve are made quickly and easily, making a saving in time and money. The valve cage and seat discs may be removed without disturbing the diaphragm chamber.

REQUIRES MINIMUM VAULT SPACE

Smaller vaults are needed when Reliance "C.B.V." Regulators are installed. Compact vault installations are made so that every part of the Regulator is easily accessible, yet the vault space required is comparatively small. This feature is important in figuring costs when distribution and other types of gas regulation vaults are to be constructed.

INTERCHANGEABLE PARTS

Numerous valve and diaphragm chamber sizes are always available to meet all varying load demands. Spring, pilot, or weight loaded diaphragm chambers permit operations over a wide range of pressures. Stabilizer can be provided when required.

Reliance manufactures a complete line of regulators and filters. Send us your gas regulation problems and we will see that you receive a Reliance Bulletin, which will describe the valve that will meet your requirements. For more information on C.B.V. Regulators, write for Bulletin 50.

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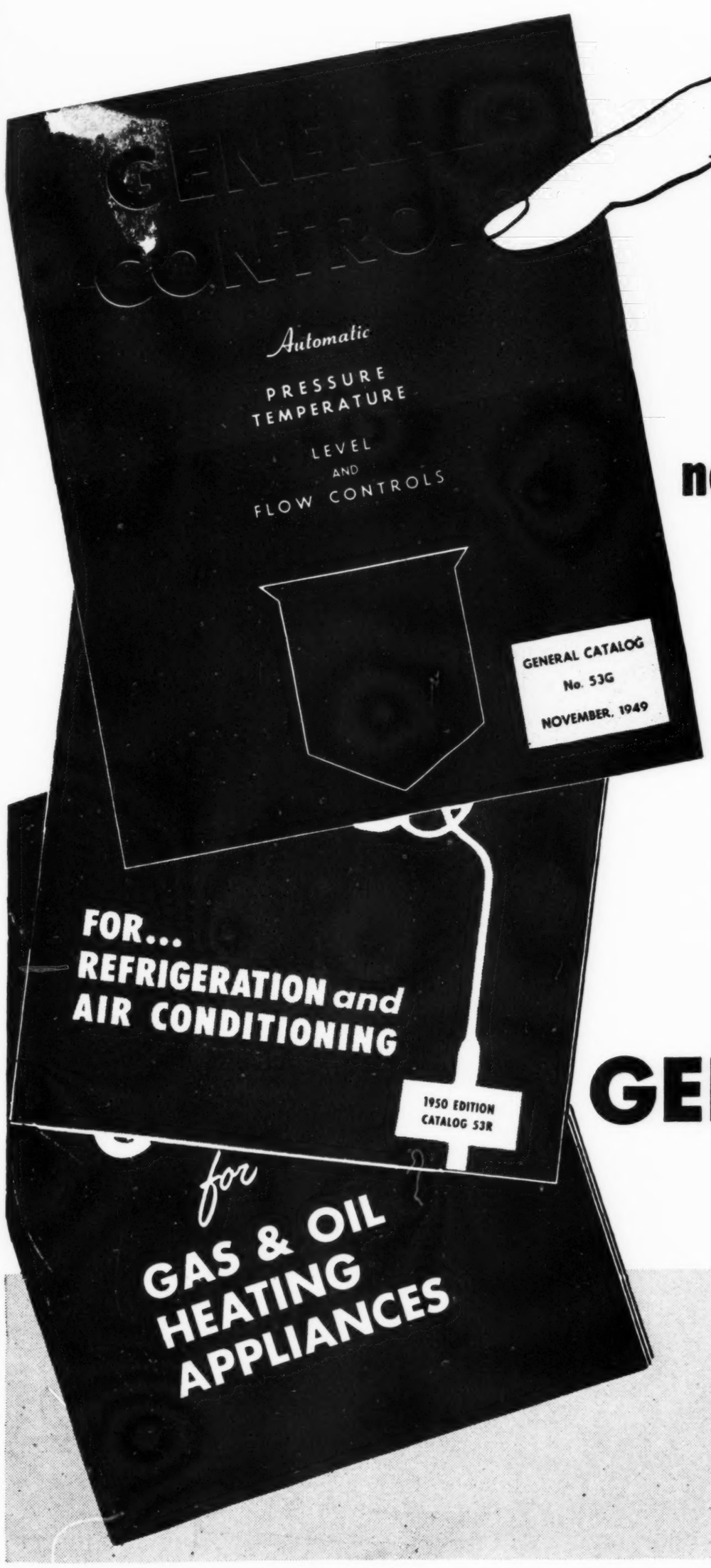

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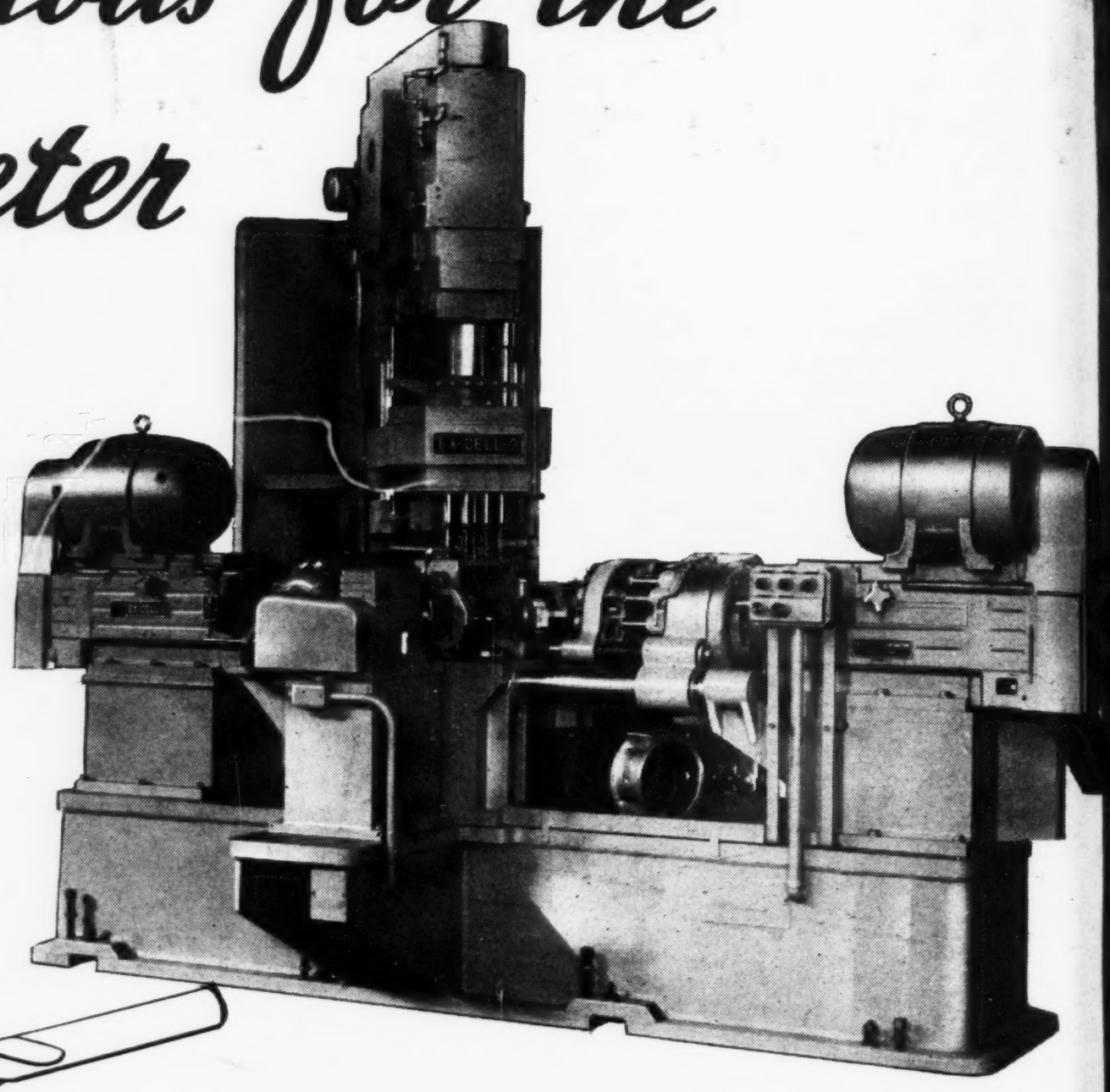

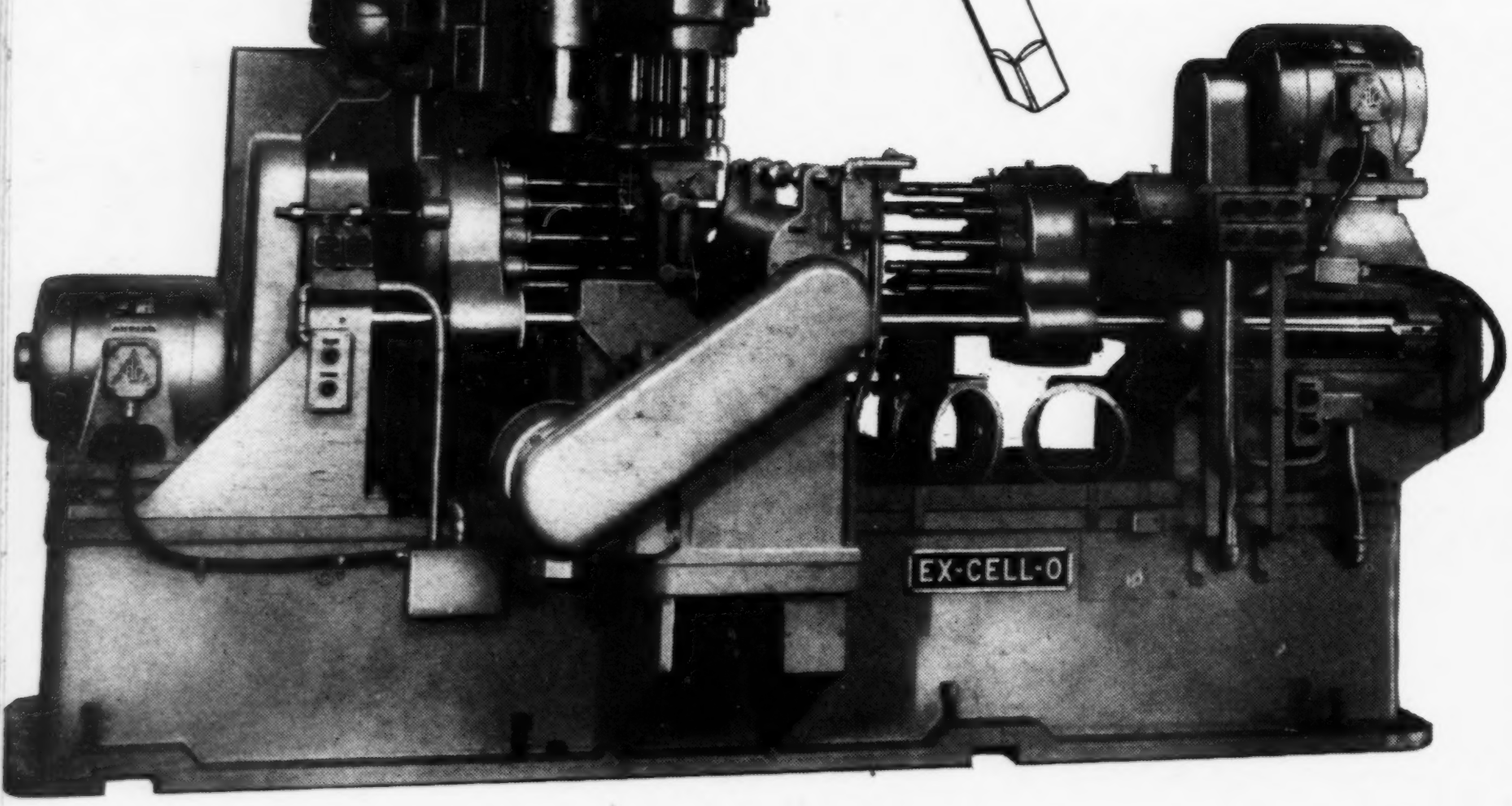

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